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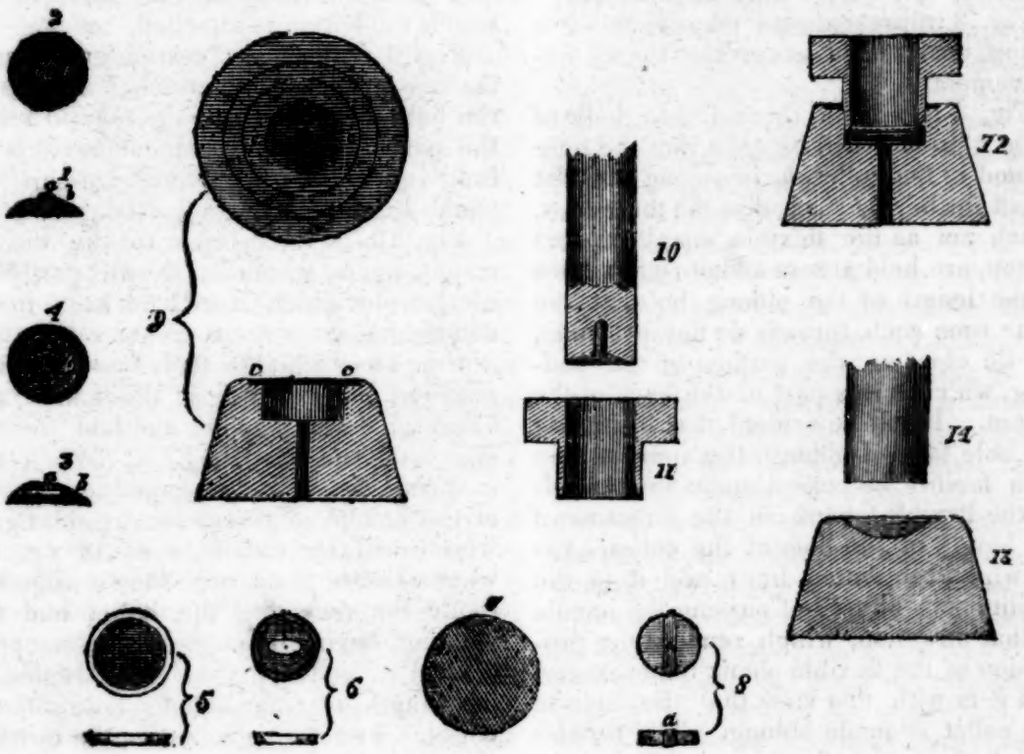


[From the London Repertory of Patent Inventions, &c.]

Specification of the Patent granted to JOHN ASTON, *for an Improvement in the Manufacture or Construction of Buttons.*—Sealed July 10, 1834.

My invention (says Mr. Aston) relates to that description of buttons commonly called "flexible shanks," wherein a tuft of thread or woven fabric is made to pass through an opening in what is called a collet, such tuft protruding outwards for the passage of the needle when in the act of attaching this description of buttons to a garment.

Fig. 1 is an edge view, and fig. 2 a plan of one of the old construction of buttons, *a* being the protruding tuft of thread or woven fabric; *b*, the ordinary collet. Objections have been raised against these buttons, owing to the flexible tuft, by which the button is attached, coming in contact with the sides of the button-hole, and quickly wearing the same away, and making it have a shabby appearance; and this has been found to be the case to a much greater degree than with the covered buttons which were formerly very extensively in use, and in which the covering was performed by hand with the needle. Now the intent of my invention is to obviate the objection above mentioned, by an improvement in the construction of the metal collet to be used in the making such description of buttons, by which I am enabled to use a flexible shank which does not protrude, and thus admitting of such buttons being set more closely to the cloth to which they are attached, and as there are no protruding shanks, the only parts which will be within the button-hole of the garment will be the threads by which the buttons are sewed or attached, and in this particular they will very much resemble the buttons covered by hand and with the needle.

My improvement consists in giving to the metal collet of the button an oblong hole, having the threads which act as the flexible shanks laid across the short axes of such oblong hole, as shown in figs. 3 and 4, there being a soft substance or padding below the threads, which comes in contact with the face of the garment to which such button may be attached.

Fig. 3 represents an edge view of a button constructed according to my improvement.

Fig. 4 is a plan thereof. In both of these figures it will be seen that the hole formed in the collet, *b*, is oblong; whilst it will further be seen, that the threads, *a*, which act as the flexible shank in this button, are held across and at right angles to the length of the oblong hole, at the same time such threads do not protrude, but lie close on the surface of the padding, which forms part of the back of the button. It will be evident, that by having the hole formed oblong, the needle may with facility be passed under the threads of the flexible shank in the direction of the length of the hole of the collet, as is shown by the dotted lines, and it is the facility thus offered of passing the needle in that direction, which renders the protrusion of the flexible shank unnecessary, and it is with this view that the hole in the collet is made oblong. The threads which form the flexible shank will be securely held down across what may be called the shorter axis of the oblong hole, only a very small part being left uncovered, and, consequently, will not be liable to stretch.

Having thus described the nature of my invention, I will describe the best manner with which I am acquainted for making buttons according to my improvement.

Fig. 5 represents a metal shell, similar to those which are ordinarily used for making this description of buttons.

Fig. 6 shows the metal collet, the difference between which and those heretofore used is, that the hole is oblong, for the purpose before described. I would here remark, that these shells and collets are made by the fly-press, as is well understood.

Fig. 7 represents a piece of silk, or other woven covering of the button.

Fig. 8 is the padding which lies under the collet, and it has wound round the thread, *a*, as shown in the drawing, which acts as the flexible shank to the button. This padding consists of several layers of soft paper, having a piece of silk or other fabric similar to the covering of the button: this piece of silk, or other fabric, forming the surface which comes in contact with the face of the garment to which the button is attached.

Fig. 9 represents a section and plan of the die or mould into which the parts of the button are first put, in order to bring the parts properly together previous to their undergoing the final pressure by which the button is completed.

Fig. 10 is the punch to the die or mould, fig. 9, which is shown partly in section, by which it will be seen to be countersunk.

Fig. 11 is a hollow tool by which the edges of the covering of the button, fig. 7, are gathered together and laid over the edges of the shell, fig. 5. When the covering, fig. 7, and the shell, fig. 5, are at the bottom of the die or mould, fig. 9, which will be clearly seen in fig. 12, where these parts are shown together ready for receiving the collet and the padding, having the threads, *a*, wrapped around it, and lying at right angles to the length of the oblong hole of the collet. In forming a button, the circular piece of silk or other fabric, fig. 7, is to be first placed on the face of the die or mould, fig. 9, at the points, *c c*, the face of the die or mould being sunk to receive it; a shell, fig. 5, is then to be placed on the surface of the covering, fig. 7, and the two together are to be pressed down to the bottom (by the punch, fig. 10,) of the die or mould, fig. 9, in doing which the punch will enter the shell and guide it down. The punch is then to be removed, and the hollow tool, fig. 11, is to be forced down into the die or mould, by which the edges of the silk or other covering of the button will be forced towards the centre of the die or mould, and, consequently, overlap the edges of the shell; the collet, fig. 6, containing the padding, is then to be dropped into the mould or die through the hollow tool, fig. 11, the collet being uppermost. The punch, fig. 10, is the next to be forced down with pressure through the hollow tool, by which means the collet,

the padding, and the edges of the outer covering of the button, will all be forced into the shell, fig. 5, which will retain them sufficiently secure till the button undergoes the final pressure for completing it. The button thus far produced is to be removed from the die or mould, fig. 9, by a wire, which is passed up through the mould for that purpose, as is the usual practice.

Fig. 13 is another die; and fig. 14 is a punch, by which the final or completing pressure is given to the button. The nature of the counter-sinking of this die will be evident on inspecting the drawing; and it will be seen that the punch, fig. 14, has a plain face. The button, on coming from the die or mould, fig. 9, is to be placed with the collet downwards, and the same is pressed into the die, fig. 13, by the punch, fig. 14, at the same time the workman holds a piece of tissue paper between the button and the punch, to prevent the face of the button being injured in appearance by the punch.

Having thus described the nature of my invention, and the manner of carrying the same into effect, I would have it understood, that I lay no claim to any of the tools or dies or parts of the button herein shown and described, they being similar to those heretofore used in making like kinds of buttons; nor do I claim the making of the flexible shank (or part by which the button is attached) of thread; but I would have it understood, that what I claim as my invention of an improvement in the manufacture or construction of buttons, is the manufacturing or constructing covered flexible shanked buttons with collets having oblong holes, by which the flexible shank is not required to protrude, but the button may with facility be sewed or attached to the garment by passing the needle under the threads, *a*, in the direction of the length of the oblong hole as above described.

Enrolled January 10, 1835.

The following communication is only a commencement of what we hope to be able to give in relation to the "Novelty Works" of this city. There are improvements going on there which will, when completed, astonish those who are not familiar with the operations of the distinguished gentleman spoken of in the following communication. We are not sufficiently acquainted with the works yet to speak of them in the manner they deserve, but shall, when permitted, give a full description of the works, and the improvements introduced for melting iron.

[For the Mechanics' Magazine.]

Mechanical Improvements—Novelty Works.

Mr. Minor: Sir,—In visiting and inspecting the various mechanical improvements in this country, which have come into existence within forty or fifty years, and in learning the history, characters, and doings, of their several introducers, projectors and inventors, one is naturally at a loss which most to admire, the various inventions and improvements, or the talents and ingenuity of their authors.

In connection with the subject of mechanical improvements, I had often heard mention made of Dr. Nott. I had seen several kinds of stoves, both for heating houses and for culinary purposes, said to be invented by him, which I thought displayed ingenuity; and I had seen a steamboat, of somewhat novel construction, which also bore his name, both as inventor and proprietor. But having never yet, to my knowledge, been favored with a sight of that gentleman, and having, through the medium of common report, previously to any knowledge of his mechanical reputation, formed an idea of him as a gentleman of uncommon scientific and literary acquirements—a minister of the gospel of the most distinguished rank—and president of a very respectable collegiate institution; I could not but imagine that though he had by some lucky thought hit upon some improvements in the construction of stoves, and, perhaps, might have some vague, abstract notions respecting the nature and management of steam, in propelling boats, yet his knowledge must be altogether superficial.

But, being in New-York a few days since, and hearing of a large establishment, called the *Novelty Works*, said to be owned by Dr. Nott and others, I procured from a friend a note of introduction to a gentleman who was one of the partners, and visited the place, when, on presenting the note, I was not only permitted to examine every thing in and about the concern, but the gentleman, with the kindest attention and the utmost politeness, accompanied me through every part, and explained every thing which needed explanation.

This examination left no trace of the

impression I had received about the doctor's superficial knowledge. I found an immense establishment, in which were carried on all the different branches and operations, in any way connected with making stoves, steam engines, boilers, and almost every other article of large machinery, and even steamboats; the whole divided into its proper departments, and each department furnished with the most ingenious and perfect apparatus I had ever seen. A spacious yard, which contains the establishment, is enclosed to keep out idle intruders, and each department has a shop by itself. I saw in each department more or less improvements from the common modes of doing the same business, among the most important of which were a steam-boiler and a mode of facilitating the melting of iron, making a saving of heat and time; each of which, and several others, were well worthy of distinct notice. I could not but gaze with wonder on this establishment, with all its system and improvements, that the whole should be planned and directed by the head of one person, who, at the same time, was actively engaged in other avocations of a nature so widely different.

"And still I gazed, and still the wonder grew,
That one small head should carry all he knew."

There was a kind of charm that still heightened the pleasure of this interesting visit, from the recollection that I had often in former days rambled over the ground when it was in open fields, an hour's walk from any part of the city, and hardly, by a common cultivation, reclaimed from the state of nature. The spreading population of the once distant city, with all the din of business, has now reached the establishment; and it seems placed as a corner stone, or as a guide and pattern to the city, to lead them on in the road to perfection.

I quitted this place with reluctance; but if life and health permit, I shall visit it again, and shall notice the several improvements more in detail.

ARCHIMEDES.

We would ask for the following communication an attentive perusal, especially by the mechanics of this State, and others who are opposed to the present system of State prison labor. They will not, we are sure, willingly stand by and see the introduction of the silk manufacture, if, by concert of action, and a continued opposition, they can prevent it.

[For the Mechanics' Magazine.]

Progress of Civilization and the Arts.

It appears, not only from the history of our times, but of all past ages, that the progress from the savage state to that of high improvements in civilization, with its millions of useful arts, is not by gradual advances, but by sudden starts, the effect of some accidental exciting cause; and that whatever may be the state of any portion of mankind, if no such exciting circumstance happens to take place, they will remain in that state, without any advance toward improvement for ages, and perhaps forever. We see portions of the human family which have probably always remained in as unimproved a state as human nature can exist in, and show no signs of ever being otherwise; and we also see other portions which, from time immemorial, have remained with very little improvement, at once awaking, as if from sleep, and in a few years making advances which seem to outstrip the imagination and bid defiance to impossibilities.

Fifty years ago, the various mechanic arts, and the branches of science on which they are founded, were but very little better known in this country than they were to the aboriginal inhabitants five hundred years before. It is true, we had a few men who could make and repair horse shoes and plough-shares in a clumsy manner, but machinery and the fine arts, and even the finer branches of the common arts, were wholly unknown; or, at least, unknown in practice. Even in England, where they are now probably as far advanced as in any part of the world, two or three hundred years since they had made no progress; and throughout Europe the case was nearly the same.

But the art of printing had kindled a flame which was to light the world to an immense field of discoveries, without which it would have remained forever inconceivable. This light had began to spread and to show the outlines of useful knowledge, when the art of spinning cotton by machinery and of propelling that machinery by steam were discovered in England. These together gave an impulse to the spirit of invention, producing effects which no human foresight could have anticipated, and which no one was so credulous as to believe, if it had been foretold.

It is now forty-eight years since the first attempt, and forty-two years since the first successful one, to introduce cotton machinery into this country, and the introduction of steam power has since followed. Before that time many branches of business, which are now too common to excite notice, would have been subjects of extreme wonder; and many things we now see done every day

would then have subjected the person who did them to the charge of witchcraft.

These two inventions, that of spinning by machinery and that of propelling that and other machinery by steam, may be set down as the pioneers which have introduced into this country almost every valuable improvement in the arts which we now possess; they have effected a greater change than ever took place before in any country in four times as long a period. It can be truly said, that in the above short space of time we have progressed from a state of comparative ignorance in the arts to an equal rank with any other nation. We have almost every useful art, carried on in a flourishing condition; and have made and are daily making in many of them valuable improvements. There are now but two important branches which we have not already fairly introduced and carried to a respectable degree of perfection. These are pottery and silk; and these are now in the act of being introduced under circumstances which guarantee their arrival, in a short time, to the highest degree of perfection. We possess all the materials in abundance to perfect the first, and fair specimens are already produced. For the second we have advantages decidedly superior to those of any other nation. It has been demonstrated by those whose knowledge and veracity can neither be questioned nor doubted, that the American silk is superior to that of any other nation; and a thousand facts show that the mulberry, which is the peculiar food of the silkworms, if not indigenous in our soil, thrives in it better than most other trees. The establishment of these two branches will soon make the second great and perfecting era in the history of the arts in this country. The various ornamental branches, as drawing and painting, and other minor parts of the business of manufacturing pottery and silk, will be necessarily improved and extended, and the whole compass of arts will exhibit the effects of new and powerful stimulus.

And it must, therefore, be a subject of regret to every person of patriotic feelings, who understands the subject, that the legislature of this State has, at its last session, passed an act to introduce the manufacture of silk into our state prisons, which, though it proceeded, no doubt, from the purest motives, will, if it has any effect, produce injury rather than benefit.

The business of manufacturing silk is destined, in a short time, to become a principal source of our national wealth; and what is of infinite importance, it seems to be designed by the discriminating eye of infinite wisdom to be almost exclusively the business and employment of females. The first discovery of its use was made by an empress—the labor is more appropriate for women and children than for men, and the fabrics when completed are more particularly designed for their use than for males. Women are, in general, more industrious than men; and are willing to apply themselves more steadily to business, if they can receive adequate compensation. But the use of machinery has relieved the hands of the female community from a great part of the labor which was formerly necessary in clothing themselves and their households. They have not, however, lost their habits of industry, but would cheerfully and proudly pursue and conduct any honorable business which would be productive of profit, and their general habits of economy as well as industry would be a sure guarantee of their success. Thus, while our wives, daughters, and sisters, were helping on the road, not only to competency, but to wealth, without lessening or encroaching on our own proper field of profitable labor, their business would open an increased and extensive demand for such labor in machinery and fixtures. Instead of being taxed to support them for the sake of those charms we so much adore, and which are necessary to our very existence, they will more than compare notes with us in profit, while their charms will not only be increased by wholesome exercise and the expression of self-approbation, but still heightened by more rich and elegant clothing, wrought by their own delicate fingers.

From all these considerations the silk business ought to be hallowed, and sacredly appropriated to the department of female management. No man ought to engage in it any farther than as an assistant, to furnish the necessary fixtures, and to aid in cultivating the trees, and also to prepare the machinery necessary in manufacturing it. At the heads of this noble department our females will feel new importance in scale of being, while they are not only clothing and adorning their persons with the richest fabrics of their own making, but adding immense sums to the national wealth. Under these circumstances, will they not feel their rights invaded and encroached on—their prospects and profits interfered with? and what is still worse, will they not feel themselves insulted and degraded by the proposed competition with them in the state prisons, and by making them fellow laborers with base wretches whose crimes have deprived them of liberty, and shut them from the sight of mankind? If they do not feel all this, and feel it with the spirit of strong resentment, they are not the beings we think them.

But besides all this, there is no other branch of business in the whole compass of the useful arts so completely unfit for the employment of convicts in a state of con-

finement—so sure to defeat the object the legislature had in view, (which was doubtless to make the convicts earn their living without interfering with the rights of free citizens,) as the culture and manufacture of silk. The business of planting and cultivating the mulberry trees we should certainly think inconsistent with the state of confinement in which they must necessarily be kept. The feeding and taking care of the worms is much more appropriately the business of women and children than of men, even if the prices of the labor were the same. The reeling the silk has ever been, and must always be, the business of females; the rough and large fingers of men are unfit for it. All that remains, then, is the weaving and dyeing. The weaving by the power loom is already commenced by Mr. Gay, at Providence, with the most perfect success, and all plain silk fabrics will soon be woven by it; and every man acquainted with cotton manufacturing, knows that women are better attendants on the power loom than men, independently of the difference in prices of labor. For weaving figured and other fancy articles much skill is necessary, which can only be acquired by a thorough education in the intricate branches of weaving, and will require complicate and expensive machinery. The dyeing might, perhaps, be done at the state prisons to advantage, where the goods are manufactured in the neighborhood; at any considerable distance the profits would not pay for transportation.

This is no exaggerated statement—no distorted picture of the case. It will be found on trial to be the plain truth in every particular. Who then will advocate the introduction of silk manufacturing in the state prisons? We think no one who possesses a knowledge of the facts, and who is in his sober senses. S. B.

Delaware and Raritan Canal.

To the Editor of the Mechanics' Magazine:

Dear Sir,—I have just passed over the Raritan and Delaware canal, which I found in excellent condition for navigation. You are, doubtless, aware that this canal was originally designed to accommodate the coasting trade, by which the delay, hazard, and expense of the route round the Capes would be materially obviated. In this respect it is an important communication; but, like most other improvements in facilitating intercommunication, it is found to be highly beneficial in promoting other objects than those originally contemplated. By means of tow-boats it affords a very cheap and expiditious transportation between New-York and Philadelphia.

The tow-boats, or barges, are towed through the canal by horses, and on tide water by steam-boats. The barges carry from 100 to 150 tons, and are drawn through the canal by two to four horses. Barges of over 200 tons have passed through the canal. The latter, however, are too large for convenient management, and it is considered, by those navigating and managing the canal, that barges of 100 to 150 tons are best adapted to its navigation. This size appears to move with ease, and are very conveniently governed by the common tiller. I saw a loaded schooner of about 100 tons moving at a velocity of two miles to the hour, drawn by two common horses. The horses worked moderately, and appeared to make no more than ordinary effort. The barges tow easier than the sail vessels of same burthen.

A daily line of packet boats has recently been established. One of the packet boats is on the Burden plan: having two long cylinders placed about 10 feet apart, on which the cabin is supported. I saw this boat moving (by three horses) at the rate of about 7 miles per hour. The horses did not appear to labor as much as they do on the packet boats of the Erie and other small canals that I have seen when moving at the rate of 4 miles per hour. The swell created by this boat was less than that made by packets on the Erie canal at four miles per hour. The appearance was fine: the horses trotted along without any extra effort, and the boat glided elegantly through the water. The average speed of the boat, including all detentions at locks, &c., is 7 miles per hour.

The length of the canal is 43 miles. The locks are 24 feet wide and 110 feet between gates. The depth of water is 7 feet, and its minimum width 70 feet. I observed, however, that a great portion of it was from 80 to 100 feet wide.

Experience on this canal exhibits the great economy in transportation on large canals over small ones; and as the expense of construction is not as great in proportion for large canals as for small ones, it therefore seems highly important, when a *large trade* is to be accommodated, that the canal should have liberal dimensions. In the great canal communications between the Atlantic and Western states, sufficient attention has not been paid to making the navigation the most perfect and economical that was practicable. The length of those canals, and the great amount of property that will ultimately seek a market through them, will demonstrate their want of suitable adaptation to the great and growing trade they were designed to accommodate. The projectors appear only to have viewed the great superiority of a common or small canal over turnpike roads. This, when designed to accommodate the transportation

for short distances, and comparatively for moderate amount, would, doubtless, have been wise; but when applied to lines hundreds of miles in length, where the transportation was materially affected by the value of the article transported, and where the amount of trade is great, this policy does not meet the case. It should not, however, be forgotten, that those canals, already made, were planned in the infancy of trade, with limited knowledge in the science of canals; and it is, therefore, matter of pride, that in a country so recently reclaimed from a wilderness, we have done so much. At the same time it would be unwise not to profit by experience in our future operations in constructing canals.

Respectfully, your ob't sv't.

[For the Mechanics' Magazine.]

To set out the Holes in the Circles of the Index to a Machine for Cutting the Teeth in Geer Wheels.

Rule. Take several convenient numbers for a circle that is most used, and find the least common multiple of them, by the rule laid down in Pike's Arithmetic, page 69.

Example 1. We will select for the first circle the numbers 12, 16, 20, and 24.

4)12 . 16 . 20 . 24
3)3 . 4 . 5 . 6
2)1 . 4 . 5 . 2
1 . 2 . 5 . 1 = 240

Example 2. We will next select for the second circle 10, 15, 21, 25, and 30.

5)10 . 15 . 21 . 25 . 30
3)2 . 3 . 21 . 5 . 6
2)2 . 1 . 7 . 5 . 2
1 . 1 . 7 . 5 . 1 = 1050

2d circle.

Example 3. For third circle, 40, 60, 80, and 100.

10)40 . 60 . 80 . 100
4)4 . 6 . 8 . 10
2)1 . 6 . 2 . 10
1 . 3 . 1 . 5 = 1200

for 3d circle, &c.

By the above rule, I have calculated the holes for several circles, which are as follows:

1st, A circle of 240 holes will cut 120, 80, 60, 48, 40, 30, 24, 20, 15, and 12 teeth.

2d, A circle of 144 holes will cut 144, 72, 48, 36, 24, 18, 16, and 12 teeth.

3d, A circle of 200 holes will cut 200, 100, 50, 40, 25, and 20 teeth.

4th, A circle of 72 holes will cut 72, 36, 24, 18, 12, 9, 8, and 6 teeth.

5th, A circle of 132 holes will cut 132, 66, 44, 33, 22, and 11 teeth.

Which is the most that is in common use.

S. A.

[From the Journal of the Franklin Institute.]

On the comparative Corrosion of Iron, Copper, Zinc, &c., by a saturated solution of common salt. By A. D. Bache, Prof. of Nat. Philos. and Chem., Univ. Penn.

To the Committee on Publications.

Gentlemen,—An inquiry was addressed to me some months since, by Mr. Joseph S. Walter, Jr., in relation to the material which would be most proper to be used for pipes to convey a strong solution of common salt to a pump intended to raise it, and for the material of the pump itself. From this solution it was intended to recrystallize the salt. The circumstances being of a somewhat complex character, I determined not to be satisfied with the indications of general theory, but to try the experiment, under the circumstances of the case, as nearly as might be possible. The materials in relation to which inquiry was particularly directed, were iron, copper, brass, lead, and zinc. Of these, the rapid oxidation of iron, when exposed to a solution of common salt, is well known; the corrosion of copper by sea water is also well known; the influence of the earthly muriates contained in the ocean prevents this case, otherwise very closely resembling that in question, from corresponding precisely to it, the common salt referred to containing these muriates only as impurities. Zinc does not decompose water readily, and oxidates very slowly, even when exposed to the combined action of air and moisture; it also ranks below sodium in the list of electro-positive metals; its chloride, however, is soluble. Lead is readily acted upon by the combined agencies of air and water, first oxidating, and then passing to the state of a carbonate; its place in the list of positive electrics is below zinc, and, of course, below sodium, which latter we should expect, therefore, to have the greater affinity for chlorine; the protoxide of lead, however, and several of its salts, interchange elements with chloride of sodium. The chloiide of lead is insoluble, and hence the presence of soluble muriates acts as a protection against the corrosion of lead by water.

As the experimental results directly obtained may possibly prove of value to others than the estimable individual for whom they were to be applied, I have thought it right to put them on record.

The materials used were iron, copper, brass, lead, and zinc, the metals being as presented in commerce, and, therefore, probably not quite pure. They were prepared in rectangular plates, about two and a half inches in length, and three fourths of an inch in width, and varied in thickness from .03 to .07 of an inch. These were placed in glasses containing saturated solutions of

common salt, rather less than one fourth of an inch in depth from the top of each plate being left exposed to the air. The vessels were left uncovered, and the evaporation of the water of the solutions was supplied from time to time during the exposure. The temperature in the room in which the vessels were placed, was not very different from 50° Fahr. during any part of the time.

After an exposure of about three weeks, the plates were removed from the solutions, and carefully washed and dried. Having been weighed before placing them in the solutions, they were now again weighed, and the loss of weight ascertained.

The iron plate was found covered with oxide of iron, strongly adhering to it in part, and in part deposited at the bottom of the glass containing the solution. There was upon the upper plate, and in the glass, a deposit of proto-chloride (white) of copper, colored by carbonate of copper, and a similar deposit upon the brass plate. The lead and zinc had been, to all appearance, very slightly acted upon; there was upon the latter a white deposit, probably of oxide of zinc.

The following table shows the amount of surface actually exposed to the solutions, the weight of the entire plates, and the loss of weight by the exposure. I have not reduced the weights used to grains, because the object is merely to obtain comparative results.

Material exposed.	Surface exposed.	Weight of plate.	Loss of weight.
Name.	Sq. inch.	Grammes.	Grammes.
Iron,	4.656	6.320	.312
Copper,	3.936	10.720	.058
Brass,	4.138	5.150	.029
Zinc,	4.572	6.115	.003
Lead,	4.762	20.080	.013

From the foregoing data I have calculated, below, the loss of weight, in grains, which a surface of forty square inches, or a plate of twenty inches on each surface, and very thin, of the materials would have suffered, and the relative loss by each material, referring to that which lost least, namely, the zinc, as the standard of comparison.

Material.	Loss of w'ght by 40 square inches of surface.	Comparative loss by exposure of same surface.
Name.	Grains.	Ratio.
Zinc,	0.40	1.00
Lead,	1.68	4.20
Brass,	4.31	10.78
Copper,	9.07	22.68
Iron,	41.27	103.18

The corrosion of the iron, with the same extent of surface as zinc, and exposed to a solution of common salt for the same length of time, is thus shown to be upwards of one hundred times that of the zinc. The zinc appears to protect the copper in the brass, probably by rendering it electro-negative, and thus diminishing the affinity of the chlorine, which would otherwise destroy the copper.

Since the experiments indicate zinc and lead as the materials to be selected from those named, on account of the slight corrosion which they suffer, lead would obviously have been the material selected for the pipes to conduct the solution of salt to the pump, and zinc for the material of the pump, the selection depending upon well known properties of these metals.

The coatings formed upon both the lead and zinc, would protect the underlaying surface from action, unless removed by mechanical force.

On Light.—Nothing can be more interesting to the philosophical horticulturist, than the phenomena of the influence or agency of light in the process of vegetation. It has been very commonly asserted, that the germination of seeds cannot be effected under the agency of light; but this is one of the fallacies which have originated in dogmatical assertion, and passed current among superficial observers. Seeds are generally buried too deep; the greater number of them, it may be admitted, develope their radicles and seed leaves best when they are covered with a very shallow stratum of light, moist earth; but numbers would perish and never rise at all, were they not sown upon, and not under the surface of the soil; witness the seeds of the birch, the azalea, the kalmia, &c.; and others (even of the common garden seeds) will swell, send out first their radicles upon and then into the soil, and shortly after produce and elevate the plumules, and become perfect plants. Any one may assure himself of these facts, by laying seeds upon the flattened and moistened surface soil of a garden pot in any stove, vinery, or hot-bed.

Our chief object, however, is to solicit the attention of the scientific reader to the effects of light upon trees and shrubs under glass roofs. Experience appears to have assured us that the coloration of leaves and flowers is effected by the presence of solar light; but in particular

and individual instances, the effects of this mighty agent are widely dissimilar. The beautiful camellia courts shade; the tender leaves of the vine, on the contrary, seem to revel in the utmost power of a mid-day sun, while the erythrinæ elevate every leaf and leaflet, as if they would drink in the sunbeams. The orange tribe seems to be peculiarly influenced by light during the winter months.

It was lately communicated to us from a quarter which claims the utmost attention, that a set of orange trees in a house, where the foliage was far below the glass, dwindled, or became very unhealthy; but that upon bringing them much closer to that medium, a manifest change was effected, and the trees assumed so rapid a growth, that they would have pushed through the glass had they not been removed to a house with a higher roof.

How do the solar rays act through the medium of glass?

That they are more or less radiated and dispersed, cannot be doubted; and in proportion as the plant is removed from the glass, the wider and more dispersed will the portions of the rays become; and in inverse proportion will be the power of these broken rays. In our answer to our correspondent, we suggested that the solution of the phenomena might be found in this dispersion of the rays; and consequently, that just in proportion as the head of the tree or shrub approximated to the glass, the less would be the dispersion, and the greater and more direct would be the solar influence. We find this idea is confirmed in the effect produced upon the leaves of the pine apple plant (*ananassa.*) If the plant be near the glass, unshaded by other foliage during the height of summer, the growth is much arrested, and a deep red or brown tint is suffused over its surface. In the damp dells, and in the mass of shade in the forests of Sierra Leone, where the pine apple is immersed in a pestilential atmosphere, loaded with vapor as that of a steam bath, the leaves are of an intense sombre green. One of the most profound philosophers of the day, whom we consulted on this mysterious agency of light, while he admitted that the dispersion of the rays might be considered an influential, though not the sole actuating cause of the phenomena, suggested that a greater heat and drier atmosphere prevailed in the upper part of the orangery; and that these might also be considered agents in the promotion of the more healthy and luxuriant growth. While we see the beneficial and astonishing effects of direct solar light, we cannot but feel surprised at the prejudiced practice which still prevails in the culture of the beautiful citrus family. Everywhere its subjects are immersed in sombre gloom, and everywhere they dwindle, and are the prey of coccus and disease. No plants are of more easy culture, and none possess greater interest. The orange tribe of plants merits a conservatory in its own right; and therein uninterfered with by other foreigners of dissimilar habits, and protected during the entire year, they thus would flourish in luxuriance, and we assuredly believe would bear abundance of perfect and delicious fruit.—[Scientific Tracts.]

The following address to the Mechanics of Easton, Pa., will be found well worthy of a second, aye, of an ft-repeated perusal. It is in a style which every mechanic and every apprentice can understand; and it states facts which it is important for every practical man to know. It refers to individuals who have, by the force of talents, industry, and perseverance, arisen from obscurity and indigence to the most honorable stations in the history of the country and of the *world*; to men who have conferred benefits upon mankind beyond the power of man to estimate and appreciate; and, what is of more importance, it indicates the path by which they arrived at that station, and, therefore, the course for others to pursue who would become, like Rittenhouse, Fulton, and Evans, the benefactors of mankind.

An Address to the Mechanics of Easton, Pennsylvania, delivered at their request, by James Madison Porter, on the 4th of July, 1835.

In comparing man with the rest of the animated part of creation, it will be found that his superiority consists not in his animal powers or capacities. He has neither the strength nor the speed that characterize the greater portion of the brute creation, and enable them successfully to attack or defend. He is, of all animals, the most helpless in infancy, and the least capable of enduring the changes of the seasons and the inclemencies of the elements. His imbecility and incapacity to take care of himself is continued through a long infancy, and even in the maturity and vigor of man-

hood, his physical powers are of an inferior order. Whence, then, does the superiority of man arise? It is from *the mind*, the immaterial mind, which enables him to lord it over the rest of creation, and make them subservient to his wants or caprices. Well then might the poet say,

"I would be measured by my soul,
The mind's the standard of the man."

Philosophers have been much divided on the subject of the powers of the mind—whether the mind is a mere capacity for improvement which requires something to evolve it, or whether talents are innate. It matters, however, but little which is right. In either case the improvement of the mental faculties, by reading and study, developes its capacities and enables it to bring its resources into practical use.

In considering the subject to which your attention is now necessarily called, it will be attempted, in some slight degree, to trace the influence of mental developement in relation to the mechanic arts—which at this day must be considered the most beneficial, practical illustration of natural philosophy, as applied to the ordinary useful purposes of life.

In the infant ages of mankind, the mechanic arts were little practised. Man's first lot was probably in the mild regions of the equator, where the great luxuriance in the products of nature, and the little occasion there existed for the erection of buildings to shelter him from the inclemency of the weather, or the procuring of much apparel for the same purposes, were illy calculated to elicit the mechanical powers or principles lying like an unsprouted germ in his mind. Necessity has ever been the mother of invention, and thus we see that ere this globe was visited by that deluge which swept all the human family, but the favored household of Noah, from its surface, which had been overspread by wickedness, the necessities, the conveniencies, or the curiosity of man, had induced considerable progress in the mechanic arts. We learn from the word of sacred truth, that in a few generations from the great progenitor of mankind, and perhaps even while he yet lived, cities were builded, musical instruments constructed, and mechanism in metals carried on. Cain built the city of Enoch—Jabal was the father of such as dwelt in tents and have cattle—Jubal of such as handled the harp and organ—and Tubal-cain an instructor of artificers in brass and iron.

At the period of the deluge, something over sixteen centuries and a half from the creation, there is no doubt that considerable perfection had been attained in many of the useful and practical branches of mechanism. The ark itself was perhaps one of the best specimens of art for the purpose for which it was intended, that ever was produced, for the great Jehovah himself condescended to be the instructor of its immediate maker; and wherever he has set an example of mechanical skill or arrangement, every thing merely human stands back abashed. Subsequent to the deluge which destroyed the earth that *then was*, and gave man this *new earth* which we now inhabit, and which exhibits so many geological proofs of the existence of that deluge, and the accuray of the Mosaic account of the creation and early history of the globe, the mechanic arts were practised and extended, as the increase of the human family spread them abroad on the earth, as the extent of light and knowledge, and consequently the refinements of life, prevailed.

It would be out of place here to attempt a history in detail of their progress in the various arts and sciences. Much pains and labor have been bestowed on this subject to unbosom from the monuments or rubbish of ages the claims of nations and of people to the rank of pioneers in the works of art.

The cities of Babylon and Nineveh were built some 250 years before the time at which the best authenticated accounts fix the commencement of the first of the pyramids of Egypt; and the confusion of tongues at the attempted erection of the tower of Babel must have preceded the commencement of the first pyramid between 50 and 100 years.

The erection of the first of these pyramids is ascribed to Apachnes, the third of the race of shepherd Kings of Egypt, about 2,095 years previous to the birth of our Saviour, and some years previous to the time when the patriarch Abraham visited Egypt; and it is evident

from the skill exhibited in their structure, the immense masses of stone of which they were composed, the order and system with which they were planned and executed, as a consequence from which, they have endured, in defiance of time and the elements, until the history of the men and nations that reared them has been nearly lost to the world, and only known by the unravelling of the hieroglyphics which abound in them, that the principles and practice of permanent and durable architecture had then attained to considerable perfection, and that much of mechanical skill must have been used in removing the material from the quarry; in conveying it to and depositing it on the building, and in dressing and finishing each block for its appropriate place.

It was not, however, in architecture alone, that the advance in the mechanic arts was exhibited. From the rude coverings of skins, the first garments worn by the ante-diluvian world, subsequent to the expulsion, the ingenuity of mankind had invented the construction of fabrics as well for garments as for tents. Subsequent to the deluge, and as far back as 1850 odd years before the Christian era, when Eliezer of Damascus was sent by Abraham to the land of his brethren to obtain a wife for his son Isaac, he takes with him golden earrings and bracelets, as presents for the intended bride, and we find them having pitchers and other utensils of convenience in housekeeping —and the bride, when she met her future husband, was veiled.

The making of bricks, we have authentic accounts, was in use more than 2000 years before the Christain era. The erections of the buildings before mentioned—of the ark by the Israelites in their journey—of the various heathen temples of Egypt, Greece, and Rome—the splendid temple by Solomon—and the Colossus at Rhodes, with other instances among other nations, until the overthrow of the Roman Republic, and the establishment of the Empire, show, that at and before the Christian era, great progress had been made in various arts, tending to minister to the necessities and luxuries of mankind.

The Grecian models of architecture have never been excelled in elegance. The Greeks understood the laws of proportion in the construction of their edifices, in an especial manner. Yet there were many principles in natural philosophy little, if at all, known to them. The principles of hydraulics, which are not yet fully known, were then even less perfectly understood. They knew not that water would rise to its own level; and hence, instead of the simple modern resort to conduit pipes, they incurred immense expenses in rearing arch piled upon arch, to construct their acqueducts to carry large supplies of water over depressed spots of ground.*

Archimedes flourished about 260 years before the birth of our Saviour. Whatever might have been known in practice previously, there was little of the theory of mechanics philosophically understood. He has the credit of discovering the exact operation and power of the screw, the inclined plane, the pully, and the lever—of the latter of which he was so enamored as to say to the second Hiero, King of Syracuse, "Give me a place to stand on, and I will move the world." And yet it would seem that these, or some at least of these powers, must have been in use among the Egyptians some fifteen to eighteen hundred years before, or how could the immense masses of granite and other stone forming the walls, the columns, the colossal figures, and other monuments of ancient Memphis, Abydos, Antæopolis, and Thebes, ever have been raised from their natural beds, and transported to the temples, the grottos, the sepulchres and other edifices which they, in part, composed or decorated?

From the days of Archimedes onward, the science of mechanics was taught in the schools. The philosopher and mathematician searched further into the theory, whilst the result of their investigations was put in use by practical artisans, and submitted to the unerring test of experience. In the dark ages, which succeeded, as the Roman Empire declined

* Pliny informs us that water can be raised by tubes of lead, and the excavations at Pompeii would show that, at and before the reign of the Emperor Titus, baths and fountains were thus supplied. But even among the Romans they knew no material of sufficient tenacity for large supplies of water, if they indeed supposed that conduit pipes could be used on so large a scale.

and fell, and ignorance and superstition wrapped the world in their sable habiliments, there was little of improvement in the mechanical branches of science, and little of practice, except in the branch of architecture, and those domestic arts with which the world could not dispense.

It was not until towards the close of the 16th century that the rapid developement of the physical sciences commenced; and there is not perhaps on record in history any more extraordinary contrast than that of the slow and limited progress of those sciences, from the early ages of mankind up to that time, and the rapidity with which they have since been enlarged and spread abroad.

Until the art of printing was discovered and put in practice, the additions to the stock of knowledge on all subjects were few and far between. The mass of mankind were little interested in them, and if the observations made and the knowledge acquired by a few enquiring minds in any age were not lost in oblivion, they were not spread abroad. It seemed to be a part of the philosophy of the ancient and the monastic school to keep their knowledge wrapped up in learned mystery, as a thing too sacred for common observation. It was not then supposed that the sciences could exist in, and be illustrated by, common objects, and have a place in the Mechanic Arts. But, no doubt, many a bold and adventuring mind did push its enquiries beyond the ordinary routine, and taking its flight into the regions of speculation, made valuable observations, which failed to benefit mankind, because they perished without a record. Towards the middle of the 16th century, this art of printing, of all others the most valuable to mankind, was discovered, and by the commencement of the 16th century, had come into pretty general use, and enabled every one to make his ideas known to the world. On this subject it has been well said: "The moment it took place, the sparks of information, from time to time, struck out, instead of glimmering for a moment and dying away in oblivion, began to accumulate into a genial grow, and the flame was at length kindled which was speedily to acquire the strength and rapid spread of a conflagration. There was an universal excitement in the minds of men throughout Europe produced by the first outbreak of modern science, but even the most sanguine anticipators could scarcely have looked forward to that steady, unintermitted progress which it has since maintained, nor to that succession of great discoveries which has kept up the interest of the first impulse still vigorous and undiminished. It may truly be said, that there is scarcely a single branch of physical enquiry which is either stationary or which has not been for many years past in a constant state of advance, and in which the progress is not at this moment going on with accelerated rapidity."

There is an active principle in the human mind which is elicited by excitement, but which, unmoved, is inert. As in water, so in mind. The stagnant pool soon becomes putrescent. The turbid and agitated ocean is healthful and pure. 'Tis the action of the waters that secures their purity. The diffusion of knowledge has tended to the increase of civilization and wealth. These, in turn, have given opportunity to the diffusion of taste for intellectual pursuits; and to the increased and enlarged opportunities afforded from the 16th century to the present time, we must mainly attribute the great extension of knowledge in every thing connected with science and the useful arts. Mind has been brought into competition and collision with mind. Scientific truths have been developed and tested, and brought to bear on the common affairs and business of life.

These results have been attained in all the arts and business of man. The age in which we live may emphatically, beyond all others, be said to be the age of mechanics; and much as we have progressed, we must not flatter ourselves that we have attained perfection in any of them. As much as we are beyond those who preceded us, in all probability, we shall fall behind those who succeed us. The impulse is given: the mind of man is pursuing the investigation of the *useful* — the knowledge of one age is transmitted to the next, and so we may increase upon increase until, the command will go forth that "Time shall be no more." Nor will the increase and developement of our faculties then cease.

Adam Smith, in his "Wealth of Na-

tions," describes a philosopher as a person whose trade it is to do nothing, and speculate on every thing. If Adam Smith had lived at this day, he probably would reverse this definition; for the great, vast, and most beneficial results which have been attained, in increasing the wealth of nations, of which he wrote much and perhaps knew but little, have been thus attained by the labors of philosophers, systematically applying the principles of true science to the improvement of the Mechanic Arts. It is principles which are the objects of enquiry to the natural philosopher, and the elucidation of a truth may be completely accomplished by the most familiar and common-place facts. In truth, philosophy in modern days has descended from its stilts, and mixing in the common affairs and business of life, is, by the elucidation of its principles in a familiar manner, become the common acquaintance of all who reflect. The observation of the fall of an apple, led the immortal Newton to the discovery of gravtiation, and other things, equally common and apparently trivial, have led to other important results. To the natural philosopher there is no natural object unimportant. From the last of Nature's works, the greatest lessons may be learned. The scientific mind applies principles readily to every incident as it occurs, and finds improvement and delight in the pursuit. He finds

"Tongues in trees—books in the running brooks—
Sermons in stones, and good in every thing."

"Accustomed," says an able writer, "to trace the operations of general causes and the exemplification of general laws, in circumstances where the uninformed and unenquiring eye perceives neither novelty nor beauty, he walks in the midst of wonders. Every object which falls in his way elucidates some principle—affords some instruction, and impresses him with a sense of harmony and order. Nor is it a mere passive pleasure that is thus communicated. A thousand questions are continually arising in his mind—a thousand subjects of enquiry presenting themselves which keep his faculties in constant exercise, and his thoughts perpetually on the wing, so that lassitude is excluded from his life; and that craving after artificial excitement and dissipation of mind, which leads so many into frivolous, unworthy, and destructive pursuits, is altogether eradicated from his bosom."

It may be asked, "What has all this to do with the present occasion?" The answer is, that every mechanic art is the reduction to practice of scientific principles. The carpenter or mason who lays out his building by the use of the base 6, the perpendicular 8, and the hypothenuse 10, or corresponding numbers, has the demonstration that he is laying out the building at right angles, in the 47th proposition of the first book of Euclid's elements;—the sum of the squares of the base and perpendicular being equal to the square of the hypothenuse. They, too, will more fully understand how to spring their arches and truss their girders, by understanding the principles upon which the means used accomplish the ends intended, than in the mere copying, without reflection, the work of others. For although a theorist, without practice, would, in all probability, erect but a sorry edifice, yet where a knowledge of principles is combined with practice, the advantage is apparent to all. The tanner, in preparing his leather, is a chemist in practice—so, too, the saddler and shoemaker, even in the preparation of their wax ends, in giving proper consistency and tenacity to the materials used, independent of the philosophical principles in the shapes and forms of their work, and its adaptation to its intended purposes.

It were endless, however, to enumerate all the examples of this truth in the trades and occupations here assembled. It exists in them all, and the instances I have cited are perhaps the least striking of any that might be given.

What was it that raised David Rittenhouse, a native of Pennsylvania, above the ordinary clockmakers of the country in which he lived, and placed his name high among the learned of the world? What was it that raised Brindley, from an apprentice to a Derbyshire millwright, to one of the greatest engineers and mechanics which the world ever produced? Neither of these great men originally received more than the rudiments of an English education. It was the application of their giant minds to the study of principles that placed the one at the head of the philosophers and astronomers of

his time, and made the other the companion and the adviser of the King, Lords and Commons of his native land, so that scarcely any public work was entered upon without his superintendence and advice.

And what too placed Fulton, another son of Pennsylvania, so high in the estimation of the world?—It was not his birth. It was not this world's wealth. It was the cultivation of his mighty intellect, which, but for his *reading* and *reflection*, like the diamond in the mine, might have lain obscure, unnoticed and unknown.

Oliver Evans, of Philadelphia, in his day, and that too within the recollection of him who now addresses you, was esteemed a crack-brained enthusiast, when he avowed that the child was then born, who by the force of steam should travel from Washington to New-York in a day.

His language was, "People will travel in stages moved by steam from one city to another, almost as fast as birds fly—fifteen or twenty miles an hour." "A carriage will set out from Washington in the morning, the passengers will breakfast at Baltimore, dine at Philadelphia, and sup at New-York, the same day."

The first of these assertions has been accomplished, and the second will be, before we are three years older. Yet this man, when in 1787, he petitioned the legislature of Pennsylvania for encouragement and assistance, to test the possibility of using steam as a motive power for wagons or carriages, was considered *insane*.

Oliver Evans was originally an apprentice to a wagon maker or wheelwright. But he was a boy who thought and read, and his attention was called to the expansive power of steam by the heating of a gun barrel in a blacksmith's fire, in which about a gill of water had been confined. He read and reflected, until he made as great an improvement in the use of steam, as perhaps any who preceded him.

As steam has been referred to, let us for a moment advert to the mighty engine it has become in the hands of men. Its expansive power was known to the ancients: "The elegant toys of Hiero—the beautiful experiments of Porta and Decaus—the modification of the Greek machine by the Italian Branca—the ingenious ideas of Hautefeuille, and their masterly extension and developement by Papin, contain all the rudiments required for a perfect machine, wanting only to be touched by the magic hand of some mechanical magician, to form a structure of surpassing ingenuity and semi-omnipotent power."

The total neglect with which these individual schemes were regarded, is not the least extraordinary circumstance in the history of the steam engine. And when the Marquis of Worcester, towards the close of the seventeenth century, made his first attempt, imperfect as it was—yet successful, in applying steam as a moving power, he was unable to interest the public in the matter, and it fell almost, if not entirely, into oblivion, until Captain Savery, thirty years afterwards, succeeded in combining a mechanism in which steam or elastic vapor was the motive power. Newcommen carried it somewhat farther. The improvement thence progressed, until the invention of Bolton and Watts, perfected, as was supposed, the system of condensation, so as to give the greatest possible power to a given quantity of steam generated. Our own Fulton adapted it in practice, the first successfully, to the propelling of boats, and, in the short period he lived thereafter, not less than fifteen steamboats were built and put in use, under his own direction. Suffice it to say, that it is now used as the motive power for almost every purpose. Steam has added to the productive faculties of Britain what would be equal to some hundreds of millions of operatives; and what has it not done for our own country, where the price of labor is higher than in foreign countries?

Steam and water, by the aid of improved machinery, are accomplishing wonders, and indeed it would seem that we knew not where the perfection of machinery will end. This much we do know, that we must keep pace with the improvements of the times. Who now would think of making cut nails with the hand-machine in use less than thirty years since? On a recent examination before the House of Commons in England, it was testified, "A cotton manufacturer who left Manchester seven years since, would be driven out of the market by the men who are now living in it, provided his knowledge had not kept pace with

those who have been, during that time, constantly profiting by the progressive improvements that have taken place in that period."

There is a very common error existing among those who have never reflected on the subject, that these improvements in the Mechanic Arts which have so increased and economized the products of labor, are prejudicial to individuals, by depriving them of work. All experience has shown that it is not the result. The reduction of price always increases the quantity sold in a corresponding degree, and thus the amount of labor which must be done by hand, is kept up, so as to give equal, if not increased employment to operatives. To give a familiar illustration:—Some years since all the floor boards used in our cities, were planed, tongued and grooved by hand; now they are principally, if not altogether, done by machinery. Sash, too, in all our large cities, until lately, were made entirely by hand; now they are made in many places by machinery. In both these items, the prices of the article have been reduced fifty to seventy-five per cent. Many carpenters were apprehensive that these things would ruin their business, and throw them out of employment. Has such been the result? On the contrary, has there not been an increased demand for carpenters in those very cities, from the fact that the diminished expense of building in consequence of these and other improvements by labor-saving machinery, has induced so many more persons to invest money in buildings? and has not the price of labor among carpenters been so enhanced, that many have gone from the country to the cities, induced by this advance in wages?

Now, believe me, such will ever be the case in every branch in mechanism and manufactures.

The invention of the spinning wheel undoubtedly threw hand spinners out of employment at hand spinning, but gave them increased employment at other branches, in consequence of the increased demand, from their reduced price, for the articles spun.

So, too, with power looms—so, too, with the carding machine—the cotton gin—the last of which actually doubled the value of the cotton lands to the planter; and who now never sees a pair of hand cards used, unless it be for some very special purpose.

All these things had the effect of changing the direction of labor, and yet no one will doubt but that they have all tended to advance the interests of the community at large; and it may be laid down as an axiom in political economy, that, whatever benefits the community at large, must eventually benefit all the members of that community.

The great object which I have had, in throwing together these desultory observations, has been to call your attention to the propriety, nay, necessity, of improving yourselves in your various callings and trades, by learning, in addition to the practice, the principles on which your work is done—in other words, to ask you to think, to reflect, to read and learn what others have done before you, and to add your own experience to the existing stock of knowledge.

The mechanics of our country, and I flatter not when I make the assertion, are as useful and valuable a class of citizens as our country contains. In general, they may be said to fill that happy medium position in society, in which neither overgrown wealth nor abject poverty is found. To this there may be, and are some exceptions, but not enough to operate against the truth of this, as a general assertion. The question you are asked to answer fairly, and truly, is, Have you availed yourselves of all the means placed within your reach, to increase your own resources, or to sustain in society, and in the government of the country, that station to which your numbers and moral standing entitle you? If you have not, to what is it attributable? Your good sense and your patriotism are sufficiently known. It was to the mechanics of our country—of Boston—that we are perhaps indebted for the final adoption of the present Constitution of the United States. They met at the Green Dragon in Boston, in January, 1788, and recommended to the Convention of Massachusetts the adoption of the Constitution. It was Paul Revere, a brass founder of Boston, who carried these resolutions to Samuel Adams, who presented them to the Convention; and they tended much to induce that body of men to decide in

favor of the adoption of the Constitution. For the interesting circumstances which took place on that occasion, I beg leave to refer to a speech delivered by the great champion of our Constitution, Daniel Webster, at Pittsburg, two years ago this day.

On you, my friends, the preservation of that glorious Constitution, and the liberty we enjoy under it, may very much depend. What boots it that our fathers fought and toiled, and many of them fattened their native soil with their blood, if their descendants should not properly prize the blessings handed down by them? And how can we prize those blessings properly, if we will not use every means for increasing knowledge—intellectual light—among us? And why are you, mechanics, especially required to carry on this glorious work?—because, in doing so, you will be peculiarly advancing your own secular interests, whilst you will be better fitting yourselves to play your own parts, as constituent members of that government, a portion of whose sovereignty you are.

You have advantages, which, in early life, neither Rittenhouse, nor Oliver Evans, nor Fulton enjoyed. You have all the lights they have shed; and all the improvements by those who preceded and those who succeeded them, both in Europe and our own beloved land, are placed around and before you, and within your reach and power, to use and to improve, if you will.

It is astonishing the amount of information which one hour alone, out of the twenty-four, bestowed on the acquisition of useful knowledge, will bring forth. It is almost incredible, the amount of scientific works which a trifling contribution from each member of an association may bring together. There is no axiom truer than that "Time is Money"—nor than, that the heaviest taxes we pay, (as Dr. Franklin averred,) are those imposed upon us by our idleness, our pride, and our folly. The daily expense, which almost every one incurs, of a sixpence, for some matter of amusement or refreshment, which might just as well be dispensed with, would, if contributed by five hundred mechanics, and our town surely contains more than that number, produce over ten thousand dollars per annum. Yet such a tax imposed by government would be esteemed outrageously oppressive. One hour out of the twenty-four, now perhaps spent in conversation, perhaps in a beer house, or the bar room of a tavern, per chance, discussing politics, or the merits or demerits of some candidate for popular favor, in which neither side, in all probability, consults the best rules of courtesy, or the most conciliating means of persuasion, and each leaves his adversary just where he found him, or it may be yet more firmly wedded than ever to his own opinions—this hour per day, if spent in reading some improving work, or listening to a sound and sensible lecture on an interesting and appropriate topic, might enable you, in the course of a few years, to lay in a stock of valuable information, the benefit of which no one can calculate.

Can you, then, better close the labors of this grand Jubilee of Freedom, than in associating yourselves permanently together, as a Mechanics' Institute, and by your united efforts obtain a library suited to mechanical pursuits, and make provision for hearing, during a part of the year, letters from scientific men, on the various subjects connected with the sciences of Natural Philosophy and the Mechanic Arts?

The result will be that *reflection* will be induced. Your apprentices will be taught to *read* and *think*, and reading and thinking apprentices make intelligent journeymen, who in turn will make intelligent master workmen, fit to fill any station to which they may be called. An Athenæum or Reading Room is a much more fitting and improving school than some that are resorted to for spending evenings. This plan has generally been resorted to in our cities, with great approbation and unbroken success. And if the Mechanics' Celebration of Easton on the 4th of July, 1835, shall lead to a similar result here, then, indeed, may every citizen rejoice that it has been gotten up, and join in the aspiration that such an association may annually assemble on the anniversary of American Independence, and rationally celebrate the birth-day of Freedom, long as the sun holds his course, or the love of Liberty and Intelligence shall exist in the breasts of Americans.

[From the London Mechanics' Magazine.]

MARINE STEAM ENGINES.

Extracts from the Evidence given by Joshua Field, Esq. of the House of Messrs. Maudslays and Field, before the Select Committee on Steam Navigation to India.

693. You have had much experience in the manufacture of engines for steam vessels, have you not?—Yes, I have.

694. What do you consider the proper measurement and power of a steamer for a long sea voyage?—The relative proportion of power and tonnage fluctuates between two tons per horse power, and four tons per horse power, depending upon the purposes for which the vessel is intended, as well as the length of the voyage.

695. What do you say as to the measurement?—By measurement I understand tonnage. I have prepared a table which shows at one view the probable speed to be obtained by the application of engines of four different powers in vessels of the same tonnage, also the length of time for which they would be able to carry coal with each power on board. This table, if the committee desire it, I will put in.

AN APPROXIMATE TABLE, showing at one view the Tonnage of Steam Vessels, with the Power usually applied to such Vessels, the number of Days' (of 24 hours) Coals they will carry, and the probable Speed per hour they will go with smaller powers and greater quantity of coal.

Tonnage.	10 miles.		9 miles.		8 miles.		7 miles.	
	Power.	Coal.	Power.	Coal.	Power.	Coal.	Power.	Coal.
252	100	5	80	6¼	60	8¼	40	12
290	100	6	80	7½	60	10	40	15
332	120	7	100	8¼	80	10½	60	14
375	120	8	100	9½	80	12	60	16
425	140	9	120	10½	100	12½	80	15¾
480	140	10	120	11½	100	14	80	16½
534	160	11	140	12⅛	120	14½	100	17¼
597	160	12	140	13½	120	16	100	19
665	200	13	160	16	140	18½	120	21½
735	200	14	160	18½	140	20	120	23½
810	220	15	200	16½	160	20½	140	24
892	220	16	200	17⅝	160	22	140	26
980	240	17	220	18½	200	20½	160	25½
1073	240	18	220	19½	200	21½	160	27

696. Will you explain to the committee the object of this calculation; is it a comparison of tonnage with the consumption of coals and days, and the rates of going?—It is to show about how many days' fuel steam vessels will carry with larger and with smaller engines on board, as well as the average speed to be expected from each. Such a table can only be an approximation.

697. Will you first state what you consider the proper measurement and power of a steamer to go a long sea voyage?—I should recommend a vessel of from 7 to 800 tons, having an engine of 180 or 200 horse power.

698. How long would such a vessel run, and at what rate would she go?—She would carry coal for 14 or 15 days, and have a speed, in still water, of 9 or 10 miles per hour, and would realize in all weathers, at sea, an average of 8 miles while under-weigh.

699. What is the greatest proportion in tonnage and power for a steamer going a long voyage?—The greatest proportion of tonnage for vessels going long voyages may be stated at 4 tons per horse power; for short sea voyages, 3 tons per horse power; and for river vessels, as Margate or Gravesend, 2 tons per horse power.

700. What results does the power give to a vessel of the same tonnage with different powers as to the rate of going?—Great power in small vessels gives great speed, but they carry a small quantity of coal, and are soon exhausted, while larger vessels being able to carry a greater quantity of coals, work longer, and perform greater distances.

701. Then you draw this inference—the longer the voyage the less the speed?—The smaller the power, the greater capacity there is left for coal, and therefore the greater number of days' coal it would carry.

702. And the less speed?—And less speed having less power.

703. And the smaller proportion of power would of course consume less fuel in an equal time?—Exactly so.

704. Would not the greatest proportion of power consume the least fuel in equal distances?—Against winds or tides it is so; but in calms and fair winds it is not.

705. What is the greatest distance you suppose a sea-going steamer to run without changing?—The same steamer should not go more than 2,000 or 3,000 miles without a relay, or time to put the machinery in order.

706. Does that also include without

taking in coals?—A voyage of 2,000 or 3,000 miles may be performed in one stage, but it would be desirable on every account to divide it and take less coal.

707. What is the greatest distance she would go without coming to a station to take in fresh coals?—The distance is limited only by the quantity of coal she can carry.

708. What is the greatest distance you think a steamer could go without taking in fresh coal?—The greatest distance I have known a steamer to perform was the Enterprise, on her voyage to the Cape, in which she carried thirty-seven days' coal.

709. With continued steaming do you mean?—Yes; she steamed 34 days, and had three days' coal left.

710. Do you mean steaming day and night?—Yes.

711. Besides the coal, is it not necessary to give the engine rest?—It is; and the more frequently they can be stopped to clean and adjust, the better they will perform.

712. Then your observations must be supposed to apply to both?—Yes.

713. What is the comparison as to the duration between copper and iron boilers?—Copper boilers are found to last about seven years, without such repairs as render it necessary to take them out of the vessel, whilst iron boilers must be taken in four years.

714. Which would you prefer on the whole?—I should prefer copper for long sea voyages.

715. Is not the thickness of the metal an advantage in raising steam?—The metal is of the same thickness, whether the boiler be of copper or iron.

716. The salt water does not affect copper so much as it does iron, does it?—No, it does not.

717. What is your opinion of the relative advantage of the common paddle-wheel with that of any other invention with which you are acquainted?—The common simple paddle-wheel, when the dip does not exceed one sixth of the diameter, is an excellent propeller, and scarcely admits of improvement; but when vessels are so deeply loaded that the dip exceeds this in any great degree, a wheel with feathering boards will propel faster.

718. You have fitted river boats with vibrating cylinders, have you not?—Yes.

719. What may be considered to be their principal advantage over the other?—The advantage of vibrating cylinders in river boats is, that they are more simple in their construction, lighter, and occupy less space.

720. But in point of weight and space what is the advantage?—Reduction in weight is the most important consideration in river navigation.

721. Is not the power conveyed more immediately to the crank by the oscillating cylinder?—The power is more durable [directly?] communicated from the piston rod to the crank; the engines are, as it were, suspended to two strong beams, which lie across the gunwale, and project for the support of the wheels, forming an independent frame, in which the strain of the engine is confined; the whole resting on the upright sides, the weight is more equally distributed over the whole vessel; thus partial pressure on the bottom is avoided; this admits of the vessel's being of the lightest possible construction.

722. Is not the disadvantage, that it is very difficult to keep the connecting pipes steam tight in oscillating cylinders?—As we construct that part, there is not the least difficulty.

723. Has not that been found to be the case?—Speaking of those we have made, no such difficulty exists.

724. Must there not be continual wear on the connecting pipes, from the motion of the oscillating cylinder?—Not if they are properly constructed.

725. What is the largest power upon which you have constructed those cylinders?—Two thirty-fives is the largest we have made upon this construction, and that was for a sea vessel.

726. Would you think it advisable to make them of a larger power for sea-going steamers?—The principle is exactly the same in this as if on the ordinary construction; and so far as we have tried them, work just as well, and produce the same effect in speed, and economy of fuel, as our other engines.

727. What is the advantage of weight and space?—A reduction in the weight of the engine leaves greater capacity for cargo and fuel.

728. What is the extent of the improvement of weight and space?—About 10 per cent.

729. One fifth of the weight and one fifth of the space do you mean?—No; about one tenth of these.

730. Is not the pipe in the fixed cylinder, which brings the steam, connected with the cylinder by means of flanges, which are secured very tight together; and in the oscillating cylinder, must not the cylinder continually move on the end of the pipe, and is the chance of becoming less steam-tight greater in the oscillating cylinder than it is in the fixed cylinder?—No; the union is effected by a stuffing-box packed with hemp, and is kept perfectly tight without the least difficulty.

731. Is it more expensive than the other?—No, they are rather cheaper.

732. Would they not be apt to be deranged in a heavy rolling sea?—We have not found that to be the case: one has been working in a cargo vessel, between Dover and London, during the last winter to the present time.

733. What is the greatest extent of time that you have had oscillating cylinders at work?—About four years and a half or five years.

734. On the sea?—No; to Richmond.

735. That is a small high pressure, is it not?—No; it is a low pressure.

736. Have you had one on the sea for the last three years and a half?—No; only during the last year.

737. Was there not a second steamboat with an oscillating cylinder going to Richmond?—There was one to Hammersmith last summer.

738. How did that succeed?—Very well, I believe.

739. The packet boat from Dover to Calais makes use of an engine of that kind, does it?—Yes.

740. Is that one of your manufacture?—No.

741. Is not the friction greater in the oscillating cylinder than it is in the fixed one?—No; as the number of bearings and moving parts are reduced, the friction should be reduced also, unless, indeed, it be badly constructed.

751. Have you considered the construction of the American steam raft?—I have seen a description of it.

752. Do you think highly of it?—It is certainly an ingenious method of obtaining great speed in smooth water, but its application is limited.

753. What do you think of the practicability of applying it generally?—It would not do at sea; and as it must draw more water than a single vessel, it would not do for shallow rivers.

754. The speed of it is very great, is it not?—It is so stated, and I believe it may be so, for the following reasons: the two pointed cylinders, from their form, may be made of the lightest materials, and need not be made of larger diameter than is sufficient to displace the total weight; their form offers the least resistance, and their relative position gives the required stability.

755. What do you think is the best kind of coal for steam vessels, with respect to power and safety from spontaneous ignition?—Hartley, Elgin, Inverkeithing, Ward's Llanelly, Llangennech, and Lydney, are all esteemed good coals, and are free from the danger of spontaneous ignition.

756. What is that Scotch coal?—The three first named are Scotch coal.

757. How is the Welsh coal, do you consider, upon those points?—The Welsh coal produces very great heat, and is very effective; but the heat being confined to the fireplace more than other coal, it destroys that part of the boiler faster than the Scotch coal. The heat is more intense in the fireplace, and less is carried forward to the flues than by the other coal.

758. What is the comparison of the proportion of the Scotch coal to the English coal in its power?—I think they are much the same. We have made many experiments, and we do not find much difference.

759. The Welsh coal is considerably greater, is it?—I do not think it is. It has the advantage of not smoking.

760. Is not that because every part of the coal is consumed?—Yes.

761. No portion is carried off, must it not therefore be a coal of greater intensity in a given bulk on that account?—I cannot state that it is more powerful, or more economical, but the heat is more intense in the fireplaces.

762. Must it not therefore be a coal

of greater intensity of heat than if a portion of it were carried off?—It is not so productive in the flues. It does not carry its heat forward, it is more like the fire of a forge.

763. Then, including the expense and power, you would give a decided preference to one species of coal rather than another?—I prefer the Scotch coal.

764. On what account?—I think it injures the boilers less, and leaves less residuum.

765. What species of Welsh coal do you allude to?—Llangennech and Ward's Llanelly are Welsh coal, and are without smoke.

766. Under what circumstances does spontaneous ignition occur?—Coals which contain iron pyrites, and have become damp, are most liable to ignite.

767. What do you think of the Forest of Dean coal?—Some of the Lydney coal which we tried proved very good.

768. Do you ever use the Kilkenny coal?—No.

769. At what should you estimate the expense of such a vessel as you consider best calculated for a long sea voyage?—A vessel of 800 tons, and 200 horse power, would cost about £33,000, fitted out in the best manner, with engine and every equipment.

770. Then such a vessel as you stated at first, is that the one that you prefer?—Yes.

771. What would be the prime cost, and what the annual expense of such a vessel?—The prime cost would be about £33,000.

772. And what the annual expense?—Do you propose to include the repairs with the expenses of working?

773. Working and every thing else—keeping her up, and every thing.—How many days do you propose her to work in the year?

774. Every thing that is to keep the vessel going for as many days as she shall continue, to the end?—The annual cost of working such a vessel, including coal for steaming one third of the time, and all other expenses, would be about £7,000.

775. In computing the entire expense of a steam vessel, and annual charge, what amount should you say for capital, the sum for insurance, repairs and renewals, calculated to create the perpetuity of the property?—I think that would not be less than 25 per cent. upon the outlay.

791. By which means could you go the greatest distance, without being obliged to take in coals; by the working a small power, and at a slow rate, or by working with a great power, at a rapid rate: for instance, an engine of 100 horse power, working at ten miles per hour, or an engine of 40 horse power, working at 7 miles per hour?—In moderate weather the small power with a great quantity of coal; but against head winds a great power will go the greatest distance.

792. In the construction of a river steamer, do you prefer the flat bottom, with the raking bows, and a parabolic curve?—I think for river steamers, where the draught of water is not very limited, the form of the vessels adopted on our river to Gravesend, or Margate, are best for speed, they are sharp, dividing the water sideways; but, perhaps, in a very shallow river, the spoon-shaped bow might be best. I do not know any experiment that would directly set that matter at rest; there are different opinions upon it.

793. What construction do you think the best for steering a vessel round a point against a strong current?—I should think the sharp vessel would steer better than the spoon-shaped vessel.]

807. Would it be safe and desirable to use a high pressure engine in a small vessel on a river, in order to lighten her draught?—I am not acquainted with any high pressure engine that has been quite successful in a boat yet; all the high pressure engines that I have seen are as heavy as the low pressure engines, except in some few instances of a particular kind, which are not fit for general navigation.

808. How is it on the score of safety?—The low pressure engine is, of course, much safer.

813. What do you consider to be the comparative advantage of steam navigation in seas and rivers, as to its expense, and as to its certainty?—I can speak of the certainty better than the expense; the rate is increased more than double and the time halved. I have also an abstract of sixteen voyages made between Falmouth and Corfu by sailing vessels, the

mail packets, before steam packets were established; it is the same voyage, and the average is 93 days, the steam packets giving an average of 47, which is half the time.

814. What is your opinion of the comparative advantage of the navigation in rivers and by sea in steamers, as to expense and certainty?—River navigation is less expensive, inasmuch as smaller vessels will suffice, and river voyages are performed with more certainty.

815. Suppose it were one thousand miles by river, and one thousand miles by sea, on which side is the advantage, both as to expense and certainty, both by steam?—River, certainly.

816. Suppose you have a whole space of 3,000 miles to pass by water, half of which is in one case to be performed by the river, and in the other the whole by sea, which of the two should you think preferable as to expense and certainty; which should you prefer as a permanent navigation?—Two kinds of vessels being necessary in this case, I cannot speak confidently.

817. Which should you prefer as to certainty?—I should think the certainty much the same in both cases.

818. Should you think a sea navigation as certain as a river navigation?—The Mediterranean packets show it to be very certain, for the fluctuation is only a very few days, which is very little for the whole four years.

819. On which side should you think the speed would be in favor, of the sea or the river, supposing there was a current of 3 miles in the river, and that you had 1,000 miles to go against that current, or 1,000 miles to go by sea, by which, by the river or by the sea, on an average, would you pass over in the shortest space of time?—I rather apprehend the sea.

825. You have given your opinion as to the proportionate power of tonnage to sea-going steamers: on what data do you found that opinion?—From having fitted out a great many vessels.

826. Do you mean vessels employed in the service of Government, or do you mean vessels employed for private purposes?—Both.

827. What number of persons in proportion to the register of tonnage of the steam vessel would you allow for short voyages, and what for longer?—How many it would be safe or convenient?

828. No; how many men would you wish to take to man your vessel, that is, the crew?—I think about one man to every thirty tons, including the stoker.

829. What would be the proportion of passengers, or soldiers, if you were conveying troops?—About one man to a ton, I should think, or more for a short distance.

830. You have given us the quantity of fuel of every horse power, have you not?—Yes, I have.

831. What quantity of fuel, and what description do you allow per horse power per hour?—We allow eight pounds per horse power per hour.

832. And what is that calculation founded upon; is it founded upon the average of the consumption?—Upon the consumption, and upon experiments made at different periods with engines of our manufacture.

833. What sized cylinder, and what length of stroke, do you allow for 180 horse?—Two cylinders of 51½ inches, and 4 feet 6 stroke.

834. What would you allow for a 200 horse power?—Two cylinders 53 inches diameter, and 5 feet stroke.

835. What would you allow for a 250?—Two cylinders, 59 inches diameter, 5 feet 6 inches stroke.

836. What would you allow for a 300 horse power?—Two cylinders, 64 inches diameter, 6 feet stroke.

837. What pressure do you use in the boiler?—About four pounds.

838. And what in the cylinder?—As near the same as an open pipe will receive it.

839. And what proportion is the paddle wheel to be to the length of the stroke?—From four to five times the length of the stroke.

840. What breadth of float would you recommend?—For river navigation, the wider it is the better; for sea navigation, about one third the diameter of the wheel.

841. What length of time would an engine work without injury?—In one spell do you mean?

842. Yes.—They are frequently worked from Falmouth to Gibraltar, which is 1,100 miles, in one spell.

843. What is the greatest and the shortest length of time they take to do

that distance; that is, a spell of 1,000 miles?—Eight is about the shortest, and 12 the longest.

844. How long should an engine last if well managed, without repairs?—About from 4 to 5 years.

845. What parts of the engine and boilers are most liable to accidents?—Those parts most exposed, such as the wheels; then the moving parts, cross heads, beams, &c.

846. Can duplicates of those parts be kept on board?—Yes.

847. Does it require any more engineers to manage an engine of 300 horse power, than it does to manage one of 100 horse power?—It does, but not in proportion to the increase of power.

848. In proportion to the power, is a large engine more economical than a small one?—Yes, it is rather.

849. Does it consume less coal in the same proportion?—It consumes less coal in proportion as the power increases.

850. Suppose a vessel to have 300 horse power in smooth water, or a fair wind, could you work it at the same consumption of fuel which a vessel of 200 horse power would be worked at, by throttling the valves, wire-drawing the steam, or any other mode of working the engines?—Yes, you may do so.

877. Have you ever made experiments on the combustion of wood, for the purpose of raising steam?—I have not myself made those experiments, but I am aware that such have been made.

878. Are you sufficiently acquainted with the subject to give an answer as to the proportion of space alone that a day's consumption of wood would bear to a day's consumption of coal?—I can only state generally, that it requires three times the weight of wood to produce the same effect as coal.

885. You were speaking of the comparative advantages of river and sea navigation; would not the boilers last longer by supplying them always with fresh water?—They would, and that would be an advantage in favor of the river.

886. Are you aware of the improvement introduced into some steam vessels, to condense the steam in the pipes, without admitting the jet of water into the aperture?—I am.

887. If this were adopted and found efficacious, you would not use the salt water at all, neither for condensing nor for the boilers, would you?—No, I should not.

888. Do you think it likely that this will be brought to perfection?—I do not know; if it succeeds it will be a very great advantage.

889. Is the salt water more or less injurious to copper or to iron?—It is much less injurious to copper than to iron.

890. Is it in comparison with fresh water?—Yes.

891. If that plan which is now trying be carried into execution, will that diminish the burthen of the engine itself in the vessel?—No, it rather increases it; but it promises to reduce the quantity of coal.

892. That you find to be one of the effects to arise from the improvement, do you?—Yes, I think that would follow.

893. It would get rid of the condenser, would it?—No, it requires a larger condenser.

894. You mentioned that, as applied to sea voyages, copper would last about seven years, whereas iron would last only about four years; what would be the proportion in fresh water?—In fresh water, for steam navigation, the boilers last about seven years.

895. The iron boilers are you speaking of?—Yes; copper boilers are not used in fresh water; there is no inducement to use copper boilers in fresh water, because iron lasts so long.

896. Are copper boilers used in salt water?—Yes.

898. In preferring copper boilers to iron ones for salt water, do you make an allowance for the difference of the tensity in copper, and the different temperature in the boiler; that copper diminishes in tensity as heat is applied, and iron does not?—We find no difference in that respect; the copper and the iron are of the same thickness, and the question turns entirely upon their durability.

New Method of applying Carbonic Acid to the Soil as Manure.

To the Editor, &c.

Dear Sir,—I send you a short account of the method I have used to apply carbonic acid to the soil as manure. If you think the subject of sufficient im-

Fig. 2.

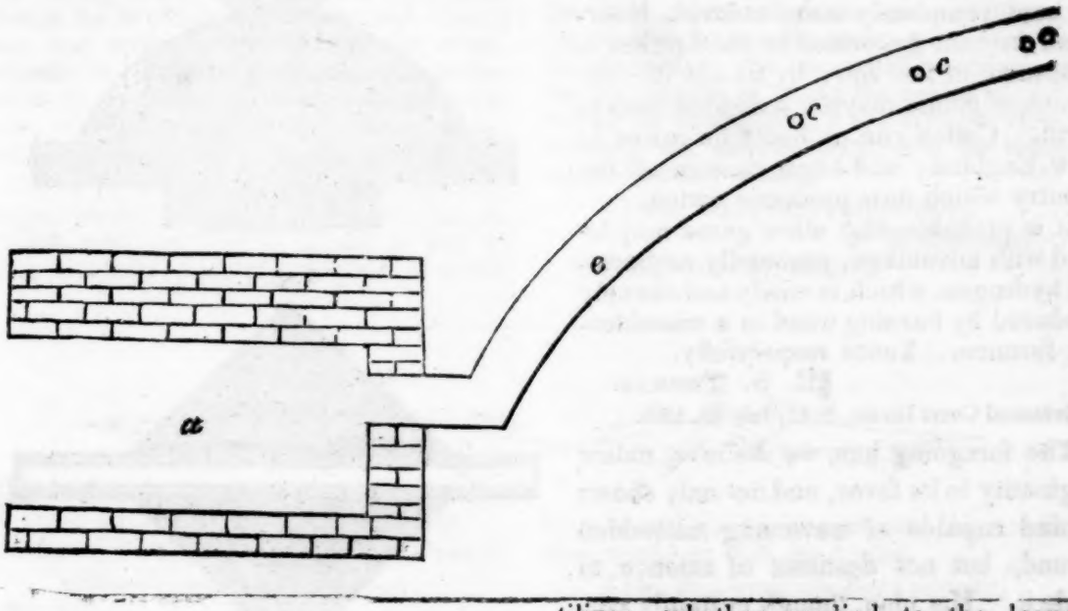
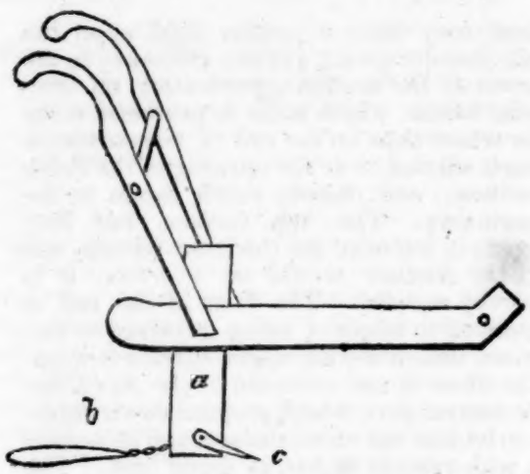


Fig. 1.



portance, you will probably confer a benefit on our country by giving it a place in your useful journal.

Fig. 1 shows the construction of the plough with which the holes are made : *a*, the blade ; *c*, the point ; *b*, the rod, which opens the holes.

Fig. 2 is a vertical section of the furnace, and a small part of the flue : *d*, the furnace, or place where the wood is burnt ; *e*, the flue ; *c c*, &c. the holes made by the plough.

In the combustion of wood or coal, a large quantity of carbonic acid gas is produced, which is known to act as a fertilizer, whether applied to the leaves or roots of plants. From the trials I have made with it, I am satisfied it can be applied to the soil with less labor and expense than any other kind of manure.

Its application is simple and easy. It is only to convey the smoke from a furnace into the soil, through holes a few inches under the surface of the ground. These holes are made with a plough, something like a common coulter, only the blade is thinner. A round rod, about a foot long, and an inch and a half in diameter, is fastened by a small short chain to the lower part of the blade, and follows exactly in the track of the point, opening a round smooth hole. See fig. 1.

The field intended to be fertilized is run off with this plough the distance the rows should be apart, so that a hole shall be under each row. A ditch is then cut across the rows so as to intersect all the holes, and when covered serves as a flue or chimney to carry the gas from the furnace to the small holes, and through them to every part of the field, where it permeates ; the soil is absorbed by its moisture, and finally taken up by the roots of the plants.

It is obvious that the furnace should be situated at the lowest part of the flue, to give it draught. See fig. 2.

There are other important results to be

gained by the use of this contrivance besides the fertility it imparts to the soil. It gives a hot-bed on a large scale, with its heat completely under control. Nearly all the heat generated in the furnace is deposited in the soil; by its aid the dominion of plants may be extended farther north. Cotton can probably be raised in New-England; and sugar cane in all the country which now produces cotton.

It is probable that other gases may be used with advantage, especially carburetted hydrogen, which is easily and cheaply produced by burning wood in a smouldering furnace. Yours respectfully,

R. S. THOMAS.

Richmond Court House, N. C., July 28, 1835.

The foregoing has, we believe, entire originality in its favor, and not only shows a mind capable of traversing untrodden ground, but not destitute of science to guide it. His plan, though certainly correct in principle, is one of those which, though extremely plausible, we think could not be decided on with certainty by reasoning *a priori*, and which consequently requires the test of experience. But Mr. T. speaks as having so tested, and we certainly see no reason to doubt. If some difficulty which we do not foresee should not be found in the practice, we should think it one of the most valuable improvements ever made in the science and practice of agriculture, and still more so in horticulture.

[From the London Mechanics' Magazine.]

Mr. Woodhouse's Angular Railway Bars.

Sir,—As the form of rails best suited for affording safety, economy, durability, &c. has occupied the attention of many scientific persons, and formed the subject of several communications in your pages, I hope, without presumption, I may be permitted to propose the annexed as a plan, in my humble estimation, calculated to effect these objects.

Some few months since, I proposed the use of an angular rail; my plan was not then matured, but as I have since given some little attention to the subject, I send you the results.

The purpose of giving an angular shape to the rail is, that the engine wheel (also having an angular grooved rim to correspond) may have a greater hold upon the rail, thereby giving greater efficiency to the power of the machine, preventing an irregular action, which must be produced when the wheel slips on the rail (a circumstance much alluded to at the opening of the Selby Railway,) and thereby much strain to the machinery. The top surface, one inch broad, is intended for the train-wheels, and where friction would be a defect, it is thereby avoided. The form of the rail is intended to admit of being reversed at any future time when the upper surface is worn. The chair is not intended to be fixed, but the central part, which projects downwards, is to let into the stone sleeper, and be bedded in with cement or not, as found best. The rail is not fixed to all the chairs, but only to the centre one; which proposition I made with another plan of Rail and Chair sent to the *London and Birmingham* Railway Directors. The size of the present rail is as follows: Depth, 4¼ inches; extreme width, 2¼ inches; surface, 1 inch; angles, from 15 to 25°, as the friction is required; the calculated weight is rather more than 51 lbs., but upon shrinking, it would probably not be more than 50 lbs. to the lineal yard.

Fig. 1.

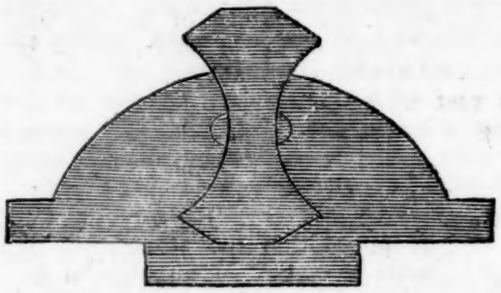
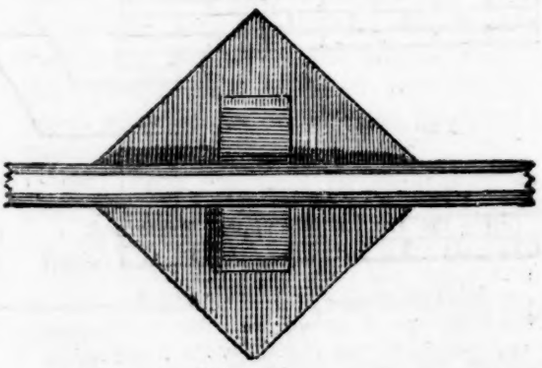


Fig. 2.



It has been objected to turning the rail when one side is partially worn down, that in proportion as it is so worn, its strength must be diminished. But as long as the internal structure of the rail is not so permanently injured as to prevent its return after deflexion to its original horizontal

form, it seems to me that it must be nearly, if not to the full, as efficient as ever.

As respects the supporting of the rails, I also proposed that instead of having the rail resting solely upon the chair, the chair should be so planned that the rail should also rest upon the surface of the stone, whereby it would be strengthened, and the stone, by receiving a steady vertical pressure, would be rendered less liable to the casualties so frequently complained of.

I also proposed that the stone-block or sleeper should be placed in an angular direction with the length of rail or line of road, whereby a greater surface of stone would be placed in the directions most required, viz. lengthways and sideways. By this plan an 18 inch stone exposes a surface of 2 feet and more to the pressure.

Fig. 1 is a section of the rail as it rests in the chair, which, when the lower portion of the chair is let into the stone, will rest upon the stone also; the two small sections are for the purpose of fixing the centre of each rail to its chair. Fig. 2 is a vertical view, showing the angular position of the stone upon a smaller scale.

I am, Sir, yours respectfully,

P. Woodhouse.

Kilburn, May 27, 1835.

[From the London Mechanics' Magazine.]

Quick and Cheap Mode of Railway Transit without Locomotive Engines.

Mr. Editor,—A great deal has been said on both sides for and against the undulating railway principle, but hitherto no satisfactory practical results have been obtained on which to found a definitive judgment respecting it; and although the shareholders of the Liverpool and Manchester Railway are deriving considerable profits, owing to the immense traffic between the two towns, still there are doubts if many other roads will pay at all: the expense of locomotive engines being so great, wherever there are considerable inclines to be overcome, and the first expense of constructing the railway so enormous, from the endeavors made by tunnelling and embanking to reduce that expense. I am, therefore, induced to send you a new plan of an undulating railway, by which locomotive engines (except on very rare occasions, indeed,) will be dispensed with; the trains will travel by the force of their own gravity from station to station, as described in the above diagram.

E E are stationary steam-engines, and O O O O inclined planes by which the stationary engines bring the trains up to a level, when the trains, going and returning, take the roads the arrows point to. I have no doubt but in many situations falls may be obtained each way for miles together. Deep cutting and tunnelling would be thus, in a great measure, dispensed with; and if tunnels in some situations were absolutely necessary, by giving them the required falls for the trains to go through them, by gravity alone, travelling through them would not be disagreeable, as no engine would go with the trains.

I am, Sir, your obedient servant,

Thomas Deakin.

Blaenavon Iron-Works, June 5, 1835.

Abstract of the Specification of a Patent for a mode of manufacturing Wrought Nails, Tacks, or Spikes, by first preparing the material, rod, or pieces, from which they are to be made, in such a manner as greatly to facilitate the process of making them, and then operating upon the pieces so prepared by means of a machine particularly adapted to that purpose. Granted to William C. Grimes, *York, York county, Pennsylvania, December 17th,* 1834.

The metal is first to be rolled or slit into rods, but not of the exact size and form of the body of the nail to be made, but they are to be broader one way, and thinner the other, the rods being usually about twice as broad as they are thick; the width and thickness of the rod, or piece, however, being such that, when it is staved, swaged, or compressed upon its sides, or edges, enough to bring it into a square form, it shall then be of the requisite thickness for the body of the nail, tack, or spike. The rod is to be cut off into the proper lengths for the nails, tacks, or spikes; they are to be cut square off at one end, the other being cut very obliquely across the rod, thus giving the requisite taper for form-

ing the point to the nail, &c., which taper will be greater, or less, according to the obliquity of the cut across the rod. The nails, tacks, or spikes, so prepared, may be finished by various methods, as by forging, swaging, or compression; and the machinery to operate upon either of these principles, to effect the same end, is susceptible of an almost endless variety of modifications.

The machines that I have adopted for the purpose are made to operate upon the principles of swaging and compression, and are constructed as follows. The prepared piece is let or dropped into the upper end of an angular trough, or gutter, which stands inclined from a vertical line about thirty degrees, (more or less.) The trough consists of two flat sides, joined at right angles, the angular point being downwards, so that, if the trough was placed in a horizontal position, its sides would rise at an angle of forty-five degrees from the horizon; the piece that forms this trough, or gutter, is the ridge, or rather one corner, of a triangular frame. Swages, or hammers, strike or act upon different sides of the nail as it descends along this trough, or gutter; these swages are placed in pairs, each pair striking upon the nail within the trough alternately, and consequently upon its different sides; their helves, at their outward ends, are jointed to the two lower angles of the frame, and in such position that they operate at right angles with each other.

The piece for the nail, &c., when dropped into the gutter, slides down to a moveable piece, or stop, that rises through the bottom of the trough, which arrests it for a moment, or until both swages have operated, when this stop recedes, and the piece instantly slides down until it is arrested by a similar stop, and is again struck by two other swages, and so on through any required number; three pair will, I apprehend, be sufficient in all cases. The last pair of swages, which are at the lower end of the trough, or gutter, fall upon, and gripe the nail, while a heavy hammer, from below, strikes upon and heads the same. The heading hammer, swages, and stops, all receive their motion from cams fixed upon a revolving shaft, running up through the triangular frame. Two or more nails may be passing down the angular trough at the same time, as the stops, after allowing a nail to pass, immediately resume their position. The swages, hammer, &c., after being raised by the cams, are forced back upon the nail by suitable springs.

I intend sometimes to form or finish the nails by pressure, which is effected in the following, or in a similar, manner. The machine, when intended to finish the nail by pressure, is to be made, generally, like the preceding machine, but the triangular frame will be much shorter, as there will be the lower pair of swages only, the inclined trough, or gutter, having a single stop. The action upon the nail, &c., is to be very similar to that before described, being alternate, and upon different sides, but it is to remain in the same place till finished. After a few reciprocating or alternating motions of the jaws, one or both of them close or press upon the nail, and hold it whilst there is a head pressed upon it. In forming some nails, the alternating motion of the jaws may be unnecessary, as they may close upon the nail at once, and form it sufficiently by this single pressure.

There should be two pairs of shears for cutting off the rod, whether it is cut hot or cold; the cutting edges of these stand at right angles, or nearly so, but both pairs may be fixed upon short arms, standing out from a strong vibrating, or semi-revolving, shaft; one pair to cut the rod off obliquely, and the other pair to cut it square. The two troughs, spouts, or gutters, into which the nails fall from the respective shears, may both lead to the same point, and terminate in one groove, or gutter, before it reaches the machine below.

I intend sometimes to cut the pieces for the nail from plates, instead of from rods. The plate should be of sound material, and rolled much broader than other nail plates. These plates are to be cut off transversely into pieces about two-thirds the length of two nails; from the sides or edges of these plates, the pieces for the nails are to be cut. The plate is to be held and turned over at each cut, in the manner followed in making cut nails, the length of nail, however, being only about two-thirds of the width of the

plate; the shears being bent into such form as to run off to the edge of the plate; the piece thus cut off is brought to an acute point, being tapered less than half its length; the taper, or points, of the nails overlapping each other in the plate. This plate should be at a red heat when the nails are cut from it, if they are to pass directly into the machine; or they may be cut off cold, and afterwards heated and fed to the machine, as before specified.

What I claim as new, and as my invention, in the before described mode of preparing the pieces, or material, for wrought nails, and in the machine for finishing them, and for which I ask letters patent, is—1st, The cutting the rod obliquely, in the way described, to form in part, or wholly, the taper of the nail, tack, or spike, whereby mere pressure, or swaging, will suffice to finish the nail, &c.: the rods being broader one way, and thinner the other, than the body of the intended nail.

2d, I claim the manner of preparing the pieces for wrought nails, tacks, &c., to be finished in my machine, by cutting them out of plates of metal, as herein before shown. I do not claim the cutting with the grain of the metal generally, that having been previously done, but confine myself to the cutting into the form, and for the purpose, described. I claim the forming or finishing nails, tacks, or spikes, or other metallic articles, by swaging in, or as they descend an inclined trough, or gutter, after the manner, or upon the principle, herein before specified.

3d, I claim the finishing of nails, or similar articles, after being prepared as herein before shown, by alternate or simultaneous pressure, after the manner, or upon the principle, before specified.

WILLIAM C. GRIMES.

Abstract of the Specification of a Patent for a Mode or Machine for making Wrought Nails, Tacks, or Spikes. Granted to WM. C. GRIMES, *York, York county, Penn., Dec.* 17th, 1834.

To make wrought nails by machinery is an object that has been sought by numerous individuals; hence it may be useful, in order to point out more clearly the novelty in the present plan, to refer to the general principles upon which preceding machines, or processes for that purpose, have been founded.

One of the first, and it is believed, an almost universal principle, that has been observed in previous attempts to make wrought nails, has been to make them from rods that were rolled or slit to the size of the larger part of the body of the nail. To taper, or to give to the nail its requisite form, from such rods, various modes have been essayed; swaging, forging, and rolling, have been tried, but the latter by far the most generally. Modifications of these principles, to effect the object proposed, have been too numerous to be here detailed. But whatever has been the modification of the machine, it has generally embraced or been constructed to operate upon only one of these principles. The novelty of the present machine consists in its being constructed so as to combine several of these principles at the same time, viz. cutting, swaging, or pressing, and forging, or percussion, and to make the novelty more apparent, the nails, &c. are not to be made from rods of the size of the body of the nail, but from broad plates, and these at a red heat. These plates are to be prepared by rolling, after the manner of plates for cut nails, but with this difference—they must be of perfectly sound iron, and two or three times as broad as the length of the intended nail, but of about the same thickness. These plates are to be cut off transversely into pieces, about two-thirds the length of two nails. From the sides of these pieces, or plates, the nails are to be formed and cut, the length of the nail running with the grain of the iron, or parallel with the length of the original plate. These plates are held, turned over, and the nails cut from the sides or ends of them, in the same manner as is practised in making cut nails, but with this difference—in making cut nails, the plate is either cold, or at what is called a black heat, whilst in my process the plates are to be at a high red heat. In making cut nails, they are cut off with a regular taper from end to end; in this process they are tapered not more than half their length. In making cut nails, the width of the plate is the length of the nail; in this process the plate is cut into lengths transversely, which

length forms two nails, by their points overlapping each other. In making cut nails, the first action upon the nail is to sever it from the plate; in this process the nail is nearly formed before it is severed from the plate.

As the plates are cut at a high red heat, they would soon destroy the temper of the steel cutters or dies, if continually applied, as in making cut nails; therefore, to prevent such injury, I cut a few nails in rapid succession, and then allow a short intermission, when the plate is withdrawn, and a jet of water is applied for an instant to the dies, which continue in motion, the plate and the jet of water being applied alternately to the dies.

Two or more of these plates should be in the fire at a time, as only a part of one plate can be cut or formed into nails without re-heating. The plates may be changed in the furnace during the time that the jet of water is let on to the dies.

The water in the pipe that conducts it to the dies should be under considerable head, or pressure, and the starting and stopping the jet may be done in various ways; the valves or cocks may be opened at regular intervals by the machinery, or a treadle may be applied for that purpose.

When the nail is to be formed and cut from the plate, such a portion of the latter as shall be necessary is placed between the jaws or dies, constructed for the purpose, and which are parallel with the end or edge of the plate, for about half or two-thirds of the length of the nail. The remainder of the dies are turned off at a slight angle, running out to the edge of the plate, thus forming the taper or point of the nail; the plate is then turned over, and its opposite side brought into the same position between the jaws, and another nail is cut, the point of which commences at the same point in the plate that the taper began in the preceding nail.

A heavy hammer for striking a head upon the nail is placed in front of the end of the jaws; this hammer is fixed upon the end of an upright rod, or helve, the lower end of which is fixed to a horizontal shaft, furnished with round tenons, or gudgeons, that work in suitable boxes on each side of the frame of the machine. From the side of this shaft, an arm projects, being inclined downwards; this arm may be about one-third of the length of the said helve. A beam or lever, whose fulcrum is near its centre, lies nearly in a horizontal position, with one end beneath the fly-wheel, and the other above the said short arm, to which it is jointed by a link. A cam on the periphery of the fly-wheel acts upon the end of this lever, or beam, the latter being gradually borne down by it, while the opposite end of the beam rises, and by its aforesaid connection with the hammer, the latter is thrown back to a proper distance; the said cam then terminates abruptly, and by a strong spring the hammer is brought forcibly upon the iron which is to form the head of the nail.

I intend sometimes to form the head upon the nail by pressure, instead of percussion.

Any competent power may be employed to impel the machine.

Machines greatly differing in form, and in the particular arrangement of the respective parts, may be constructed upon the preceding principle to produce similar results, or effect the same end by similar means. I therefore do not intend to limit myself to the particular arrangement herein specified, but to change such form and arrangement as I may think proper, while the principle remains unchanged.

What I claim as new, and as my invention, and for which I ask letters patent, is, 1st. The making or forming wrought nails, tacks, or spikes, from or upon the edges or sides of metallic plates, by pressure and cutting, after the manner, or upon the principle, herein specified.

2d. The manner of severing the plate from the nail, so that a part of the latter is left standing out beyond the end of the jaws as herein before described.

3d. The side jaw by which the plate is gauged, and the nail compressed, and removed from the jaws.

4th. I also claim the general construction and combination of the respective parts of the above described machine, by which general combination it derives that character by which any competent machinist will readily distinguish it from any of the various nail machines heretofore in use.

But I do not claim as my invention the fly-wheel, cams, levers, or any other

part of the machine, taken separately and individually; but, as aforesaid, the combination of these parts upon the principle herein fully set forth. Nor do I claim the forming of nails from nail plates, by cutting them with the grain, that having been already done; but in this particular I confine myself to the peculiar manner in which the cutting is effected. WILLIAM C. GRIMES.

[From the London Repertory of Patent Inventions, &c.]

EXPERIMENTS ON THE PRESERVATION OF SHEET-IRON FROM RUST, IN INDIA. BY JAMES PRINSEP, ESQ.—The proposed extensive employment of iron steamboats, for the navigation of the Ganges, rendered it a desideratum to ascertain what varnish or composition would best preserve the exterior surface of such vessels from the rapid corrosion to which iron is so peculiarly subject in a hot climate. A series of experiments was undertaken with this view by myself, at the requisition of government; and it may perhaps be useful to record the principal results in a journal of science.

Two sets of six wrought-iron plates, each measuring 3 feet by 2 feet, were fixed to two iron triangles, the plates being prevented by studs from coming into contact with each other. The same varnishes were applied to both sets, one being intended for entire submersion under water, the other to be only half immerged, in order to [that it might] feel the united influence of air and water.

The following were the coatings applied:

1. Common coal-tar laid on hot, and the plate heated.

2. *Thetsee* varnish of Ava, one coat. This took a very considerable time (two months) to dry, kept first in a cool room, and afterwards in a room heated by furnaces.*

3. Native *Dhuna*, applied to the iron hot, in a thick uneven coat.

4. Best white-lead paint, three coats; allowed to dry and harden for nearly three months.

5. Coachmakers' varnish, two coats; dried rapidly.

6. Spirit varnish, several coats; warmed.

7. White wax, melted on the surface.

8. White wash, of pure lime water.

9. The surface of the iron plate cleaned and guarded with an edging of zinc, soldered on.

10. The natural surface of the rolled iron sheets, covered with its usual hardened grey oxide.

Many of the foregoing were employed from curiosity only, especially No. 6, the spirit varnish, which had, on many occasions, proved quite ineffectual in preserving the surface of polished iron and steel from rust in the atmosphere of Calcutta.

The two frames were suspended as above described, one under water, the other half immersed, from one of the unused dredging boats, near the Chitpur lock gates, in the circular canal, where they were left undisturbed for three months, during a period of the year when the water of the canal was only slightly salt.

They were then taken up for examination, and presented the following appearances.

Plates under water.	Plates half above water.
1. Tar—Perfectly preserved and free from rust.	1. Tar—A few dots of rust between wind and water.
2. Thetsee — Perfectly uninjured in appearance.	2. Thetsee—A line of rust at the level of the water.
3. Dhuna—White and pulverulent; soft and easily rubbed off while wet: rust here and there.	3. Dhuna—Large cracks from the contraction of the part exposed to the sun, whitened where thick, black where thin; plate preserved above water.
4. Paint—Almost wholly disappeared, and blotches of rust on the surface.	4. Paint—Paint uninjured above water mark, and plate preserved, but below water entirely removed.
5. Copal varnish—Whitened, pulverulent, and soft; but not much oxidated.	5. Copal varnish — In air less whitened, spots of rust breaking out every where.
6. Spirit varnish —— Whitened and very rusty.	6. Spirit varnish—Very much corroded.
7. Wax — No trace of wax left, and very rusty.	7. Wax—This plate was all under water.
8. Lime—Flaky, peeled off, and very much corroded.	8. Lime—In air remains on and acts pretty well.
9. Zinc—The clean iron excessively corroded and bad: the zinc also oxidated.	9. Zinc — Much more rusty in the air than under water, where a kind of crust was formed.
10. None—The natural surface was a little whitened, and pretty well preserved.	10. None—Rusty on the edges, or where it had been scraped; elsewhere little injured.

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* Major Burney states, that three or four days are sufficient for the varnish to dry when laid on wood (Journal, vol. i. p. 172). I had not a damp vault in which to expose the plate as recommended by that officer, and that may partly account for the delay in drying; but all varnish and paint takes longer to dry on metal than on wood, from its non-absorbent nature.

The superior preservative power of coal-tar to all the substances tried, with the exception perhaps of the thetsee, was evident; the Burmese varnish labored under the disadvantage of being a single coat, otherwise it would, doubtless, from its hardness, its firm adherence, and its inalterability by water, prove fully equal as a lacquer to the coal-tar: the latter has, on the other hand, the advantage of drying and hardening as soon as laid on.

The change effected on the resinous varnishes is produced by an actual chemical combination with the water; the soft pulverulent matter is analogous to the white powder obtained by the addition of water to an alcoholic, or to an acid solution of resin.

The failure of the zinc guard, which was expected to act as an electro-positive protector to the iron, may, I think, be attributed to its being adulterated with lead, which being negative with respect to iron, would cause, as was actually the case, a more rapid oxidation of the latter metal: (the impurity of the zinc was afterwards fully proved.)

The wax and the white paint had entirely disappeared from the surface of the metal under water, before the plates were taken up; it is impossible, therefore, to say in what way their removal was effected.

The bituminous (coal-tar) coating was finally adopted, and it has been successfully applied to the iron steamer, the Lord William Bentinck, lately launched under Captain Johnston's superintendence.—[Journal of the Asiatic Society of Bengal.]

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Chemical Examination of the Petroleum of Rangoon.—By Robt. Christison, M. D., F. R. S. E., Professor of Materia Medica in the University of Edinburgh, &c.—At the close of the preceding session, the Council of the Society did me the honor of entrusting me with the chemical examination of several articles sent not long ago to the Society by Mr. Swinton, Secretary to the Government at Calcutta. The articles in question are, 1, Specimens of the *black varnish* used in different parts of Hindostan and the Burmese territories, with specimens of the juices of which these varnishes are said to be compounded. 2, Specimens of *naptha* from Persia, and of *petroleum* from Rangoon. 3, Specimens of *wood-oil*, a variety of fluid turpentine. 4, Specimens of crude *caoutchouc*, and of solutions of it in wood-oil.

The only one of these articles which has hitherto yielded results of such interest as to induce me to lay them before the Society, is the petroleum of Rangoon, which appears to contain a compound inflammable principle hitherto unknown.

The petroleum of Rangoon, termed by Mr. Swinton earth-oil, and more generally in the East, ground-oil, is probably the same with what may be procured in various parts of our eastern dominions, by merely digging a few feet into the soil. In the vicinity of Rangoon it may be obtained in immense quantity for the mere trouble of digging it. It is used in Hindostan as pitch for all manner of wood-work; and is likewise a favorite external remedy for rheumatism, being employed for that purpose in the way of friction.

I am not aware that either this, or any of the European petroleums, has been subjected to careful analysis; and I should suppose no such analysis has been made, because no chemist, even with a careless examination, could have failed to observe that it contains a peculiar principle, the discovery of which would have given the analysis publicity.

The petroleum of Rangoon, at ordinary temperatures in this country, is a soft solid, of the consistence of lard. Its specific gravity, at the temperature of 60° Fahr., is 880, water being 1000. At the temperature of 86°, it is of the consistence of thin paste, and at 90° it melts completely, and forms a sluggish liquid, which acquires more fluidity as the temperature rises. Hence in the East, durring the hot season, when it is dug for, it must be in the fluid state, and consequently entitled to its vulgar name of ground-oil. It has a powerful naphthous odor, different from that of most other petroleums.

It is impossible to analyze this petroleum by means of the ordinary chemical solvents. Most of these solvents, such as the acids and alkalies, have little or no action on it, while alcohol, which acts feebly, and ether and the volatile oils which act energetically, dissolve all it

principles indiscriminately. The only practicable method of analysis, therefore, is the process by distillation.

When six ounces of petroleum were distilled, there was first procured, at a low heat, an ounce of nearly colorless naptha; then another ounce of straw-yellow naphtha; then, at a higher heat, about another ounce, much more yellow, yet still fluid at 60° Fah.; next, a considerable quantity of a yellowish liquid, which concreted at 60° into a loose mass, composed of numerous crystalline needles and plates, in a yellow naphthous fluid; and, as the distillation went on, this matter became more and more solid, but even towards the end was not firmer in consistence than lard. The residual matter in the retort, when the heat had been raised to full redness, was a spongy charcoal.

The naphtha, when rectified by a second distillation over a lamp, and then by a third distillation from the vapor-bath, is limpid and colorless, like sulphuric ether, and its density as 779. From the trials I have made, I consider that the Rangoon petroleum, when distilled on a large scale, will yield nearly a third of its volume of this colorless naptha.

I need scarcely observe, that in eastern countries, where the fresh juice of the caoutchouc tree cannot be procured, the naptha from the Rangoon petroleum may prove a useful article. Like other kinds of naphtha it freely dissolves, or rather softens, caoutchouc; which, after the evaporation of the solvent, is recovered with its original properties. When it is to be used for this purpose, however, it must be carefully separated by distillation from the crystalline matter I am presently to describe, which rises as the distillation advances, and gives the naphtha a yellow color. For if any material proportion of this impurity be present, the caoutchouc solution dries very slowly, and long retains a greasy surface.

The yellowish, concrete, crystalline matter, like the petroleum itself, is not acted on by the caustic alkalies, or by the strong acids. Alcohol dissolves it very sparingly; ether and the essential oils, freely and entirely. None of these solvents, therefore, is of any use for separating the crystalline matter from the mass. But I have succeeded in procuring it in a state of purity by the following process:

The mass being cooled down to about 40° Fahr. it was spread out on the filtering paper, and then subjected to strong pressure between many folds of common blotting paper. In this manner, an oily-like matter was taken up by the paper, and a pale yellowish white crystalline substance was left, which was subsequently deprived of its remaining color by repeated solution in boiling ether and recrystallization. Ether dissolved it largely, forming a pale yellow solution, which, on being cooled by immersing the vessel in very cold water, became a soft mass of interwoven crystals. This mass was then taken out, spread quickly on filtering paper, and immediately subjected to strong pressure between folds of blotting paper. The yellow coloring matter, which all remained in solution in the ether after it cooled, was thus, in a great measure, imbibed by the paper; and the crystalline matter was procured in a state of purity by repeating this process twice.

On first procuring this crystalline substance, I considered it as the same with the napthaline procured not long ago from coal-tar by Mr. Kidd, as related in his paper in the Philosophical Transactions for 1821. This opinion I was led to form from the appearance of the crystals, the nature of the substance which yields them, and the process of distillation by which they were procured.

On a careful examination, however, I find that the crystalline principle of petroleum differs materially from that of coal-tar, as well as from every other known body; and I shall therefore beg leave to denominate it *Petroline*, according to the analogy suggested by the name of Mr. Kidd's crystalline principle.

As procured by the process described above, petroline forms foliaceous masses of small crystals of snowy whiteness, and bright pearly lustre. It is somewhat unctuous, and has a naphthous odor, which becomes very faint on exposure for some time to the air, and is removed altogether by boiling in alcohol. It fuses at 135° into a transparent, limpid, colorless fluid; but softens ten degrees lower. From a state of fusion it concretes on cooling into a translucent brittle mass, like wax, the density of which is 909 at 60° Fahr. At a temperature intermediate between the boiling point of water and a low red heat,

the fluid boils, and distillation takes place. The greater part of the petroline condenses in the form of a fluid, which becomes, on cooling, a translucent waxy mass, with its original properties. But, owing to the elevated temperature required for its distillation, a part is decomposed, a little charcoal is left behind, and a small quantity of inflammable gas passes over with the undecomposed sublimate. When heated in the open air, it catches fire, and burns with a dense white flame and much black smoke.

Petroline is insoluble in water, cold or boiling. Boiling alcohol takes up a small quantity, not more than a 450th of its weight, and, on cooling, deposits the greater part in minute shining crystals. Boiling ether, its proper solvent, easily takes up a fifth of its weight, which, on cooling, is in a great measure separated in a congeries of micaceous crystals, so abundant as apparently to convert the ether into a solid mass. Oil of turpentine also dissolves it in large quantity, and so does naphtha.

Caustic potass and caustic ammonia in solution have no visible effect on this substance. When boiled with it, it simply fuses, rises to the surface, and is there found, on cooling, with its usual properties. Concentrated muriatic, nitric, and sulphuric acids, are equally without action, even when aided by the heat necessary to boil each. It simply melts and rises to the surface, and, except that it becomes slightly yellow with nitric, and slightly brown with sulphuric acid, no change of property is perceptible. It has no action with acetic or oxalic acid.

With iodine, aided by a gentle heat, it quickly unites, forming a violet-colored fluid, which, on cooling, becomes a dirty greenish-brown solid, very soluble, like each of its elements, in sulphuric ether.

I have not made any inquiry into the other chemical relations of petroline, my object at present being merely to establish its claims to be considered a new principle, distinct from any other hitherto known. In its properties it resembles napththaline more than any other substance; but, at the same time, it differs from that body in very many respects. Naphthaline volatilizes at common atmospherical temperatures; does not fuse under 180° Fahr.; and, when heated a little above 400°, boils and sublimes in fine micaceous crystals. It is heavier than water. It forms a rose-colored solution with acetic or oxalic acid; and with sulphuric acid it unites to form a peculiar acid, termed the sulpho-naphthalic, which, like other acids, neutralizes bases, and forms salts with them. A single glance will satisfy every one how completely this account of the properties of naphthaline differs from the description given above of the properties of petroline.

It remains for me to determine its elementary composition. This I have not hitherto found leisure to accomplish; but I am engaged in the requisite experiments at the present moment, and will soon make them known to the society. The experiments hitherto made merely enable me to say, that it contains a very large proportion of carbon.

Appendix, December, 1834.—A few months after the preceding paper was read before the Royal Society, the author observed in Buchner's Repertorium, an account of the discovery in 1830, by Dr. Reichenbach, of a crystalline principle in tar, to which that chemist gave the name of paraffine.* As the properties of paraffine seemed from that account to be obviously identical with those of the petroline of the Rangoon petroleum, and as Dr. Reichenbach had ascertained its properties and composition fully, any farther investigation of the crystalline matter of petroleum appeared unnecessary. The original paper is now published, partly because allusions have been made to it in chemical works, and partly to serve as an introduction to the ulterior inquiry of Dr. Gregory on the same subject.

The author, soon after laying this paper before the Royal Society, examined by the same process the petroleum of St. Catherine's, near Edinburgh, of Rochdale, in Derbyshire, and of the island of Trinidad; but was unable to detect a similar crystalline principle in any of them.—[Transactions of the Royal Society of Edinburgh, Vol. xii., Part i., p. 118-123.

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ON THE FUSION AND APPEARANCE OF

* A notice of Dr. Reichenbach's researches on Paraffine will be found in the Repertory, third series, vol. xv., p. 34, in the number for January, 1833.

Refined and Unrefined Copper. By David Mushet, Esq.—The following are "a few extracts from experiments made some years ago, with a view to ascertain what effect would be produced upon the strength and malleability of copper, by retaining, to a certain extent, the alloy (chiefly tin) which is found in rough copper, and which it is the purpose of the copper refinery to discharge. In the first place, I obtained a quantity of shotted rough copper, made from the furnace in which the copper, though alloyed with other matters, first appears in its metallic form. These shots were light and flaky, hard when struck, but at the same time partially ductile. A quantity of pure shotted copper, made from the refinery, and having the form of flattened spheroids, and much denser than the other, was procured at the same time for the purpose of these experiments.

Exp. No. 1. A quantity of rough copper was fused in a black-lead crucible with nearly an equal bulk of charcoal, and poured into an open iron mould. The bar or ingot thus made was three-fourths of an inch thick, and when cold and broken, was found to have crystallized in converging striæ perpendicular to the upper and lower surfaces, and declining towards the outer edges of the bar. The grain was of a pale color inclining to gray, indicating the presence of tin.

Exp. No. 2. Three bars procured in this way were melted together in a black-lead crucible, without charcoal, and poured into a mould just at the moment when the melted copper put on a creamy appearance. When cold, the surface of the ingot thus obtained was less coppery-metallic than the surface of the ingot in the first experiment, where charcoal was used; from which it may be inferred that, owing to the absence of charcoal, a certain degree of refinement had taken place. The fracture possessed more of the red grain of good copper; the striæ were less distinct and less crystalline; and the surface, instead of being convex, as in the first experiment, was concave.

Exp. No. 3. Some of the pure shotted copper was fused in a black-lead crucible with an equal bulk of charcoal, and the resulting ingot presented a more clean and perfect mass of copper than the ingots obtained in Experiments No. 1 and No. 2. The fracture presented a series of brilliant striæ arranged from surface to surface, breaking off easily in the direction of the perpendicular fibre, a structure which seems wholly incompatible with extension or malleability.

Exp. No. 4. Some of the same pure copper melted similarly, but not poured into the mould until it had nearly lost its fluidity, formed an ingot less striated or crystallized than any of the former, with more of that minute deep orange-colored grain which is peculiar to pure and malleable copper. From the results of this experiment, and of No. 2, it would seem that when copper is poured into the mould at as low a temperature as is consistent with perfect fluidity, the fracture is less crystallized, and the color approximates to that ruby grain which indicates the malleable state of copper.

Four bars, one from each of the foregoing experiments, were imbedded in burnt lime, shut up from the access of air, and exposed in crucibles to the same temperature. The pure copper bars (Nos. 3 and 4) were on the surface considerably oxidated, but those made from the rough copper (Nos. 1 and 2) were entirely free from oxide; and from this it may be inferred that the alloy (principally tin) which still remained in the copper, prevented waste or oxidation. The bar from Experiment No. 1 was not cut, but that from Experiment No. 2 retained about the same quantity of grained striæ as before the cementation; though, compared with a fracture of the same copper that had not been cemented, the grain was redder, the color more brilliant, and the metal more ductile. The bar from Experiment No. 3 was covered with a thin coating of crystallized oxide exceedingly soft; the striæ were more enlarged and adhesive, so that the copper, in cutting, tore out in flakes, which separately were soft and ductile. The bar from No. 4, when examined and compared with an uncemented one, was more open in the grain, redder, and more brilliant; but the quantity of depth of grain was nowise altered, although the metal cut softer, and was covered with a thin crust of shining oxide. From these details it may be presumed that cementation opens the

grain, renders the bar less dense, but does not change the peculiar form of the arrangement. In each case, the copper after cementation was softer, a change which seems favorable to rolling cold. The impure or rough copper appears to be alloyed with another metal (no doubt tin,) which prevents that oxidation which pure copper in the same circumstances would undergo.

Besides the above, several bars were made from the rough copper by a slower fusion, and with a longer exposure to the charcoal, and it was observable, that the longer the exposure, and the slower the fusion, the more yellow and refined was the copper in the bar.

Some of the bars produced in the course of these experiments were attempted to be rolled; but the success was various. Of those made from the pure copper, some rolled better and others worse than any made from the rough copper; one or two bars of the latter were equally malleable with the former; but none rolled well either hot or cold. In those bars in which the striated arrangement was most perfect, the capacity for rolling was least, and those in which the minute granular fracture prevailed, generally rolled the best. It certainly does appear that this tendency to crystallize, so destructive to malleability, is peculiar to English copper made from the crucible. There are occasions, no doubt, when, the proper temperature being hit upon, the bar would roll; but these occasions are so rare and uncertain, that English copper made in this manner could not be relied upon in the manipulations connected with manufactures. There is no question that the arts in this country suffer from the peculiarity of English copper. For, in consequence of it the malleabilization of that metal is necessarily confined to the original process of refining practised on the great scale by the copper smelters. It is very different with Swedish and Russian copper, which I have seen melted in considerable quantities in large crucibles, cast into cakes or thick sheets, and afterwards rolled into boiler-plate and thin sheet-copper. This subject requires and deserves a scrutinous examination, with a view to discover the cause of the uniform tendency of English copper to crystallize; and that cause may, perhaps, be found in the process employed in this country for the smelting of copper ores, a process which, however economical and well calculated to overcome quantity, has never yet produced pure copper.—[London and Edinburgh Philosophical Magazine, May, 1835.]

[From the London Mechanics' Magazine.]

HYDRAULIC BLAST WHEEL.

In foundries, smithies, and other manufactories, large quantities of atmospheric air in rapid motion are in constant demand, and a large proportion of the motive power is spent in the supply. The pressure of fluids being equal in all directions, the aggregate amount of force employed in transmitting air by means of bellows, air cylinders with pistons, &c. is very considerable, there being the same pressure on every square inch of the blowing apparatus as on the like space of the orifice through which the air is transmitted.

The accompanying drawings represent a blast wheel lately invented by me, of which the following is a description. I have had a model of it made, and it fully verifies the correctness of my calculations; and in this case the effects must be the same in proportion on a large scale.

Fig. 1. A is a hollow cylinder (the length of twice its diameter,) which is made to revolve on the pivots O by means of a rope or belt acting on the pulley B, or by any other mechanical power. C is a stationary nose or tube, fixed to the side of the oval trough D. The trough is nearly full of water, its level being above the centre of the cylinder A, and of the small cylinder within it, hereafter described. Within the cylinder A is a spiral leaf wound round a cylinder of about $\frac{1}{3}$th of the diameter of the external one. The size of the internal cylinder need not be increased in proportion to that of the external. The leaf is soldered to both cylinders, and so rendered air-tight; it may be made of the slightest material.

Fig. 2. The water is here seen occupying the lower half of the cylinder and trough, the top being always filled with air. On the wheel's making one revolution, the *water* in E is conveyed into F; that which was before in F escapes at G, and flows round the side and bottom of the trough, outside the cylinder, to re-enter the latter at H. The air in I (which is continually supplied by atmospheric pressure of 15 lbs. to the square inch) is conveyed to K, and so in proportion for less than a revolution; and the air which was before in K is forced through the pipe at C, to which branch pipes may be attached. A continuous blast

Fig. 1.

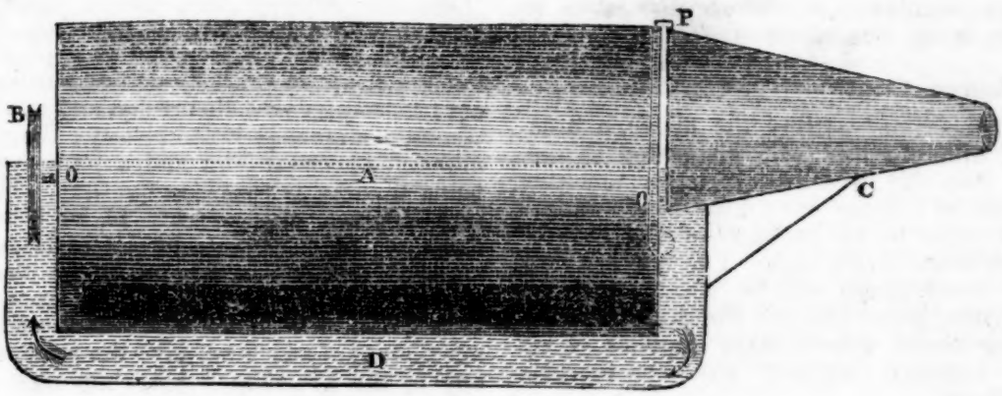
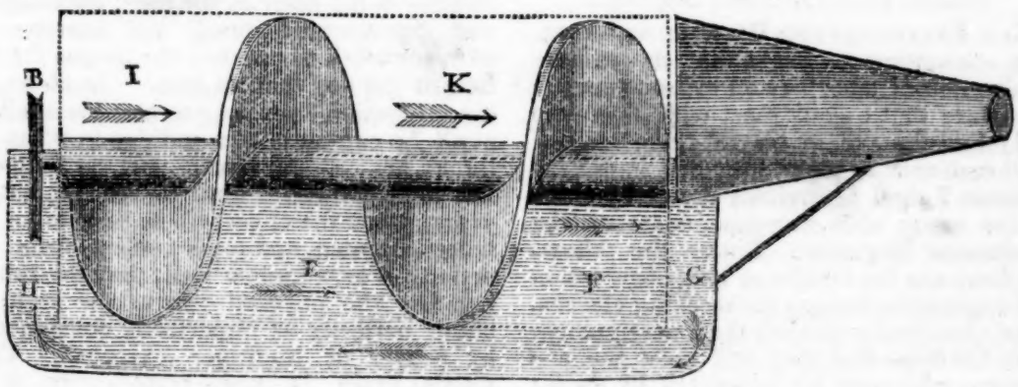


Fig. 2.

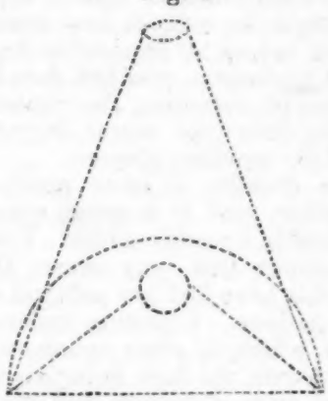


of air is thus produced, and may be conveyed to any part of a building. The pressure of the water being equal on all sides, and as it is set in motion by the inclined plane of the screw, but little power is required to keep the wheel going, for the particles of fluids move easily amongst themselves. The trough should be of an oval form. In order that no air may escape between the tube and the cylinder, a small strap of leather is fastened to the tube (which is fixed) to lap over the cylinder at P, fig. 1, and is kept down by a small weight, hung at the corner of each side, thus,

No air, once enclosed or detached from the atmosphere by the end H of the spiral leaf being immersed in the water, can possibly escape but through the nose or tube.

Fig. 3. Transverse sections of both ends of tube; and outline, as seen from its under side.

Fig. 3.



The wheel may be made of any size required. To ascertain the quantity of air discharged at each revolution: First, find the whole contents of the cylinder, which we will suppose to be 14 feet in diameter, by first finding the area of the base by multiplying the square of the diameter by ·7854; then multiply the area by the length of 28 feet, thus, $14\times14=196\times\cdot7854=154$ nearly, $\times28=4312$, contents of cylinder. But as it takes two revolutions to empty the cylinder, $4312\div2=2156$ feet of air and water discharged at each revolution, $2156\div2=1078$ feet of air less 78 feet for internal cylinder, &c.=1000 cubic feet of air discharged at every revolution. If the motive power, or the velocity, cannot be

easily regulated, a sliding-valve may be made in the side of the tube C.

ALFRED T. J. MARTIN.

Helston, Cornwall, June 6, 1835.

P. S.—Since writing the above, a practical difficulty has been suggested to me, viz. that the pressure of air for smelting should be 2, 3, and even 4 lbs. to the square inch, equal to the pressure of a column of water about 7 feet high. I do not see how this desideratum can be obtained by the foregoing plan; but still the invention may prove useful where large supplies of air are required without any considerable pressure.

[From the London Mechanics' Magazine.]

EVIL EFFECTS OF THE DIVISION OF LABOR.—In attempting to prove that the minute subdivision of labor has an evil tendency, I am aware that I shall meet with few who will admit the evil to be so extensive as I shall endeavor to point out; and it is very probable I shall be written down by some of the many able correspondents of the Mechanics' Magazine. But as the following facts are the results of long observation and experience among the working classes, I have resolved to publish them anonymously, in the hope that they will meet the eye of some who may be benefitted by them; and should they be the means of convincing even one, I shall consider myself happy in having brought the subject into notice. I have myself served an apprenticeship to a mechanical profession, and had then ample opportunities of observing the causes that tend to bring about the moral degradation of some of the working classes.

That the division of labor produces a cheaper article, and is a great source of national wealth, I readily admit. I believe were it not for this very cause, Britain would ere this have lost her political status among the nations. Groaning under a load of taxation, which no other nation on earth could have borne, we have been driven into an artificial state of society, and the division of labor with all its attendant evils is one of the results. This is illustrated by the fact that we export machinery to countries where workers are obtained at half the price: and yet these countries are unsuccessful competitors in the same market with the poor tax-eaten British. Our national vanity whispers that this is owing to our superior genius; but I contend that it is our artificial mind-degrading system of dividing labor, which by making individuals do only *one part of a thing*, with mechanical, or rather slight-of-hand, rapidity, enables us to produce a whole as cheap as our foreign brethren.

But the effects of this system upon society is truly deplorable. A poor boy, with very little education, is bound an apprentice for five or seven years, to do one particular act; he commences cheerfully, and in a few weeks can manage it completely; the only difference between him and a journeyman being that he takes twice the time. He is now doomed through life to be a *mere machine*; all the delight he felt in learning his trade is over; he has no more mental work to perform, and he goes on from day to day with his monotonous task without excitement of any kind, save the temporary one of the gin-shop: there, amongst the rudest ribaldry and mirth, he is exhilarated and *comparatively* happy. Next day he returns to his labor in the most melancholy and discontented mood, and hastens on with his work to procure the means for "a hair of the dog that bit him." In short, as his profession does not exercise his intellect at all, he cannot fail to indulge in what *he* thinks his only pleasure. Let us suppose this to be continued until he reaches man's years, when the effect will be seen in an intellect, blunted, and quite useless from inaction. For we know well, that the thinking, like the physical, part of the man, is either perfectly or imperfectly developed—by proper or improper exercise. This man's brain is unexercised, nay, it is diseased; he has acquired a sensual and ungovernable appetite for the drug that enfeebled, and still continues to enfeeble, both his mind and body, and he is in such a morbid state, that all his efforts to reform or improve his mind are ineffectual. He tries Mechanics' Institutions, and all the other schemes for improving the working classes, but to no purpose; his mind, from want of habit, cannot follow the lecturer; he gets inattentive—sleeps—and loses the thread of the subject; repeats his visits for a night or two, perhaps, and the lectures get to him "the longer the drier," until he quits in disgust, what might, under other circumstances, have been a source of enjoyment to him. When such a character enters into the solemn engagements of matrimony, his previous habits and badly regulated mind ill qualify him for the various duties of husband or father; he brings into the world a few squalid, degenerated wretches, and by his brutal conduct, drives his well-disposed partner to that temple of infamy the gin-shop, for the melancholy purpose of "drowning her cares." I will not disgust the reader by dwelling upon the united effects of their example on their thus hereditarily vicious offspring. The wretched man continues to work and drink alternately, until he reaches the workhouse if in England, and beggary and crime if in

Scotland: a poor grumbling, discontented, shameless pauper, both unable and unwilling to work; for the man who has spent twenty years of his life sharpening pin-points, or guiding a self-acting turning machine, has not physical strength to handle a spade or road hammer, even if he had not been previously wasted by dissipation. This is not an exaggerated picture; the melancholy details of evidence brought before the Factory Commission furnish multitudes of such instances. It is not the long hours, however, that is the sole cause of this evil I maintain: it is the division of labor that is the root of the evil, which I shall endeavor to illustrate by another example, *not ideal*, but like the former, *real*: and the writer has many characters under his own eye, of both kinds, to choose from.

In Scotland, some ten or twelve years ago, the division of labor was not (and is not even now) carried to the extent that it is in England, and consequently the working classes have a higher moral character, which is commonly ascribed to education, and a modern training. This is the case in a very few instances; by far the greater number of the Scotch mechanics and operatives receive a very limited education. When they are sent off to a trade, they can half read, and perhaps make shift to write the letters of their own name—but the difference rests here; the Scotch mechanic has to do a great variety of jobs, not one of which he can do so quickly as the expert Englishman.

As an instance: About twelve or fourteen years ago, an engine-maker had to learn to make a tolerable good pattern; he had to turn both iron and wood, to fit up, put together, and attach the engine to the factory; he had thoroughly to understand drawings, and in many cases had to draw himself. The reader will readily imagine, that this must be a clumsy "Jack of all trades:" this is not the case however,—he is a slow, but a good workman. Suppose exactly such a boy as we took in the former case, bound apprentice to this trade for seven years: for one year he is allowed to run loose about the work, he is every "body's body," runs messages, creeps into holes to do jobs which men cannot reach. By the end of the year, he has acquired a very rude general notion of the whole work, but can do little or nothing with his hands. He is now stationed at a bench, and from making simple articles, comes on with great satisfaction to himself to make good patterns; he then wearies, because he thinks himself master of the subject; having little mental work to perform, he is now in great danger of going astray, but happily for himself he is shifted to another department, upon which he enters with great spirit, and feels with intense delight, as bit by bit he masters the various tasks put before him. His brain thus stimulated and exercised, a thirst for knowledge is created, and he is driven in search of food for his mind to a Mechanics' Institution, where he hears and sees, for the first time, the astonishing fact, that the water he drinks is composed of two gases that burn. This leads him to endeavor to read, that he may learn more of the matter, but he finds he cannot do it so quickly as he would like; he then sets to work with good will, goes to an evening-school, and his mind being in an excellent state for receiving instruction, he makes most rapid progress. I need not trace him farther—here is a useful and promising member of society, who himself enjoys life and all its blessings. A few such (according to the strength of their intellect) turn out eminent men—the rest are scattered over the earth in the shape of managers, superintendents, and foremen, of flourishing works; and it is worthy of remark, that in all the large manufacturing towns in England you find a large proportion of Scotchmen doing the intellectual work of large mechanical establishments. This does not arise (as Sandy's vanity always suggests) from a "national superiority." John's head is just as good as his, as is seen in every case where there has been the same chance of getting the organs developed. I regret to state that the baneful system of dividing labor is fast spreading in Scotland, and the moral degradation attending it cannot be denied by the most ardent admirers of the religion and morality of that country. It must not be supposed that the character I have last attempted to describe has been exempt from temptation. No, he has kept company with the drunken and the dissolute (of which there must be a large proportion in every society;) but his mind having been properly set to work, he soon calculated the amount of real pleasure or pain to be derived from seeking after knowledge, or from a course of profligacy. Nor must I be understood as assuming that all are depraved who labor at one particular object all their lives, for there are some minds that naturally resist the influence of such causes; but the number of the good bears a small proportion to the bad in countries where this vicious system is carried to great extent. There is another demoralising effect yet to be noticed, which I shall endeavor to do as briefly as possible. An improvement in machinery often turns hundreds adrift upon society, who having spent the best part of their lives in some such trifling work as heading pins,

are too old to learn another business, and for reasons already mentioned they cannot do out-door work; their minds being untutored, they do not make a very vigorous effort to do their best at a new job, well knowing that they will not be allowed to starve in England. In many, very many cases, such men direct their blind rage to the breaking of machinery, not only the machine which superseded them, but machinery of all kinds; in short, a large proportion of the seditious, the incendiaries, the swings, machine-breakers, &c. which disturb the peace of society, are division-of-labor people, thrown out of work, and who have neither physical nor mental strength left to turn themselves to another decent employment, seeing that the few that do so are scarcely fit to earn sufficient to support a miserable existence.

It is common enough to hear the *lordly* aristocrat, or wealthy man of business, express their *disgust* in such unmeasured terms, as the "beastly multitude," the "canaille," the "scum of the earth," &c., and grumble loudly at the overwhelming poor-rates. Let them examine themselves carefully, and see that they be not aiders and abettors of such infamy. Let them remember, that the cause of this evil is *over-taxation* (and every one who directly, or indirectly, robs the public purse, is to blame for perpetuating the evil,) and not turn away in disgust from his fellow-being whom he has already injured.

We take some trouble to educate the lower animals, and if some of these our humble servants are not so tractable as could be wished, we do not vent our anger upon them, but upon their trainers. Why, then, should the higher classes *spurn* the poor, misled, untrained mechanic, whose labor has perhaps enriched them? It were a wiser course, and a way to root out the evil, were they to set on foot a proper plan of national education, inquire into, and amend, some of the absurd apprentice-laws, and put the rising generation in the way of acquiring more than one branch of a business, in order that their minds may be so far exercised as to make them good members of society, instead of converting them into *mere machines* for the acquisition of wealth. We see the good effects produced in the middle classes by education. Why, then, should a large proportion of our fellow-creatures be allowed, or rather doomed, to remain in a state of darkness? I trust these remarks will be followed out by some of your abler correspondents at some future period. I am afraid I have already occupied too much of your valuable space. L.

May 4, 1835.

Visibility of Stars in the Daytime.—Sir: On the 384th page of vol. 3, of the Scientific Tracts, I have noticed an article relative to the "Visibility of Stars in the Daytime." In answer to a request at the close of that article, I send you the following extract, from "Lecons d'Astronomie, par M. Arago, imprime a Paris, 1835."

"It is a very common error to suppose that stars can be seen in the daytime, from the bottom of pits, or wells. They cannot be seen during the day, only by the aid of telescopes, or by rising high in a balloon, or from the summits of lofty mountains. The cause which prevents their being seen with the naked eye during the day is, that the rays of the sun, reflected by the atmosphere, form a luminous veil, which obstructs the feeble light of the stars. If one body emits less than one-sixtieth as much light as the other, it becomes invisible. This can be verified by a simple experiment: place an opaque body between two lighted candles, so that the body will project two shadows; remove one of the candles so far that the light it throws upon the opaque body shall be only one-sixtieth as great as the light from the other candle. This is easily done, if we remember that the light diminishes as the square of the distance increases. The shade produced by the most distant light will no longer be visible. This is the principal reason why stars can be seen with a telescope in the daytime; the telescope diminishes the apparent distance, and accelerates in the same degree the motion of the stars." D. — [Scientific Tracts.]

Aplanatic Engiscope. — This is the name of a new instrument, on exhibition in the city of Troy. The Advertiser says, it possesses all the improvements of the microscope, from its first invention in 1612, up to the present time, and of Dr. Goring's and Mr. Prithard's Diamond and Sapphire Aplanatic Engiscope. Aquatic objects may be seen in the smallest particle of clear water, magnified to a vast extent. With the instrument one can examine the external and internal organization of the smallest animalculæ; see the motion of the fluids as they thread their way through the exceeding minute vessels which traverse in every direction the bodies of these atoms of creation, many of which are computed to be thousands of times smaller than a grain of sand, but whose bodies and all their several parts are shown by the microscope to be as perfect as those of the elephant. The skeleton larva of many of our winged insects, animalculæ in common vinegar, paste eels, dust from cheese, (which is shown to be composed of living animals,)

beautiful cuttings of wood, (showing the course of the circulation of the sap,) insects inhabiting ripe oranges, &c., together with many parts of the animal creation, too small to be examined by the unasisted eye, are presented by this wonderful instrument with a distinctness which, to be duly appreciated, must be examined. In the solar and hydro-oxygen microscopes, the spectator is presented only with the shadow of the animalculæ, thrown on a whitened screen; but in this engiscope not the shadow, but the reality is exhibited. A writer in the Troy Whig pronounces the instrument to be all that is represented in the advertisement. It is said to have been constructed by Mr. Conner, a citizen of Albany.—[Ib.]

[From the London Mechanics' Magazine.]

DAGLISH'S PRIZE RAILS AND PEDESTALS.

Dear Sir,—I herewith send you drawings of my parallel rail and joint and intermediate pedestals, with the mode of fastening them to the stone blocks or sleepers, and also of my method of keying the rails into their respective pedestal; for all which I obtained the premium lately offered by the London and Birmingham Railway Directors, with the exception of the mode of fastening the pedestals to the stone blocks, which the Committee of Reference are said to have thought inferior to the lewis-pin of Mr. Swinburn, to whom the Directors accordingly awarded a third of the premium. I have also added sketches of certain modifications of my rail and pedestals, which it might be advisable to adopt under particular circumstances, and in some peculiar localities.

Fig. 1 (No. 8 of the Competition) is an end-section of the parallel rail and *joint*-pedestal (the pedestal where two ends of different lengths of rail meet;) showing also the mode of keying the rail by cotter bolts, (No. 3 of the Competition.) Fig. 2 is a plan of the above; and fig. 3 a side-section. The weight 50 lbs. per yard. The stone blocks are from 10 to 12 inches thick, and contain from 4 to 5 cubic feet; the cotter bolts are $\frac{3}{4}$ inch round.

I have tried this form of rail against ten other forms of rail of the like weight per yard or thereabouts, not only by actually running heavy locomotive engines over them, but by means of the steelyard and lever, and have always found that it will carry more weight than any other with the least deflection. The simplicity of its construction, too, is greatly in favor of its being soundly made.

Fig. 4 is an end-section of the same kind of rail, with the *intermediate* pedestals; and fig. 5, a plan of the same.

The joint-pedestal is made of nearly twice the bearing of the intermediate ones, in order that the ends may be the more effectually secured.

The Secretaries of the London and Birmingham Railway state, in their letter to me announcing the award of the premium in my favor, (with the exception aforesaid,) that the Committee of Reference did not consider that any one of the patterns or plans sent in fulfilled the conditions required by their advertisement, (that is to say, I presume, combined in one all the advantages sought for,) but that my form of rail and chair, (or pedestal,) and mode of fixing the rail to the chair, (according to the chair pattern, No. 3, and model, No. 8,) were the best as regards the two first conditions of the advertisement; while the method of fixing the chair to the stone block, shown in model No. 5, (Mr. Swinburn's,) was the best as regards the third condition; and that the Directors had, therefore, come to the unanimous resolution, that they should not be justified in giving the premium for any one individual pattern or plan, but that 70*l.* of it should be awarded to me, and 35*l.* to Mr. Swinburn.

On comparing, however, the statements in this letter with those in the pamphlet lately published by Mr. Barlow (one of the Committee of Reference,) containing an account of the experiments made by him at Woolwich, and his Report thereon to the London and Birmingham Railway Directors, I must confess that I am quite at a loss to reconcile the two. For it appears from the latter, that Mr. Barlow not only made his experiments with my form of rail, which he pronounces to be by far the best, but recommends the mode which I proposed of fixing the pedestal to the stone block, *and not Mr. Swinburn's.*

Indeed, to all who are practically conversant with railways, it must seem as inexplicable as surprising, that the lewis-pin method should have been thought worthy of favorable mention at all, far less of being honored with a premium. Were such a mode of fastening adopted, (as it, most assuredly, never will,) it would not be long before the concussions from the passage of heavy locomotive engines, at great velocities, would infallibly split the stone to the depth of the lewis.

The mode of fastening practised by me, and approved of by Mr. Barlow, (though, strange to say, not treated with like favor by the Committee of Judges, of whom Mr. Barlow was one,) consists, as will be partly seen from inspection of the figures, in inserting plain cotter bolts through the stone, and countersinking the hole up from the bottom for the space of an inch and a half

or two inches, so as to permit the point of the bolt to drop below the base of the pedestal. I first tried screw-bolts, but was obliged to abandon them in consequence of the nuts getting, through corrosion, so fast to the bolts as to twist the bolt-ends off before they would unscrew. Fifteen years' experience has now satisfied me that the plain cotter bolt is the only one that will answer.

Mr. Barlow speaks of this method of fastening as if it were the suggestion of Mr. Vignoles. But how he should have fallen into such a mistake, I cannot comprehend; for it was not only fully shown in the models I sent in to the London and Birmingham Railway Directors, but the advantages of it were particularly dwelt upon in the letter which accompanied them. To place this beyond all doubt, I will here repeat those passages of my letter which relate to this point:

"The pedestal for the joint I would particularly recommend to be fastened to the sleeper with cotter bolts; I would also prefer fastening all the intermediate ones in like manner, though they would answer to be well nailed in the usual way, but much better with cotter bolts, as you then derive the greatest effect from the parallel rail, by keeping every pedestal firmly down. If only nailed, this may prevent the intermediate pedestals becoming fulcrums, in which case the fibres of the upper surface of the rail are not called into tension in the same ratio with those on the under side of the rail, immediately between the pedestals, while the locomotive or any other heavy carriages are passing along the line."

Again:

"I prefer the mode of fastening the pedestals with cotter bolts as by far the most effectual for general use; if even they have to be fastened with smaller bolts, (say $\frac{5}{8}$ths diameter,) more especially when they can be thus secured at as cheap a rate as if fastened by nails. The holes for the small bolts can be drilled through the stone sleepers for less than the large holes necessary to receive the wooden plugs; and the small bolt and cotter will only cost a trifle more than the nail and wood plugs, as both the bolts and cotters can be made by a machine for that purpose."

Mr. Vignoles, though he certainly did not suggest the use of the cotter bolt, has done me the honor to cause it to be adopted in the construction of the Dublin and Kingstown Railway, instead of the nails or spikes commonly used.

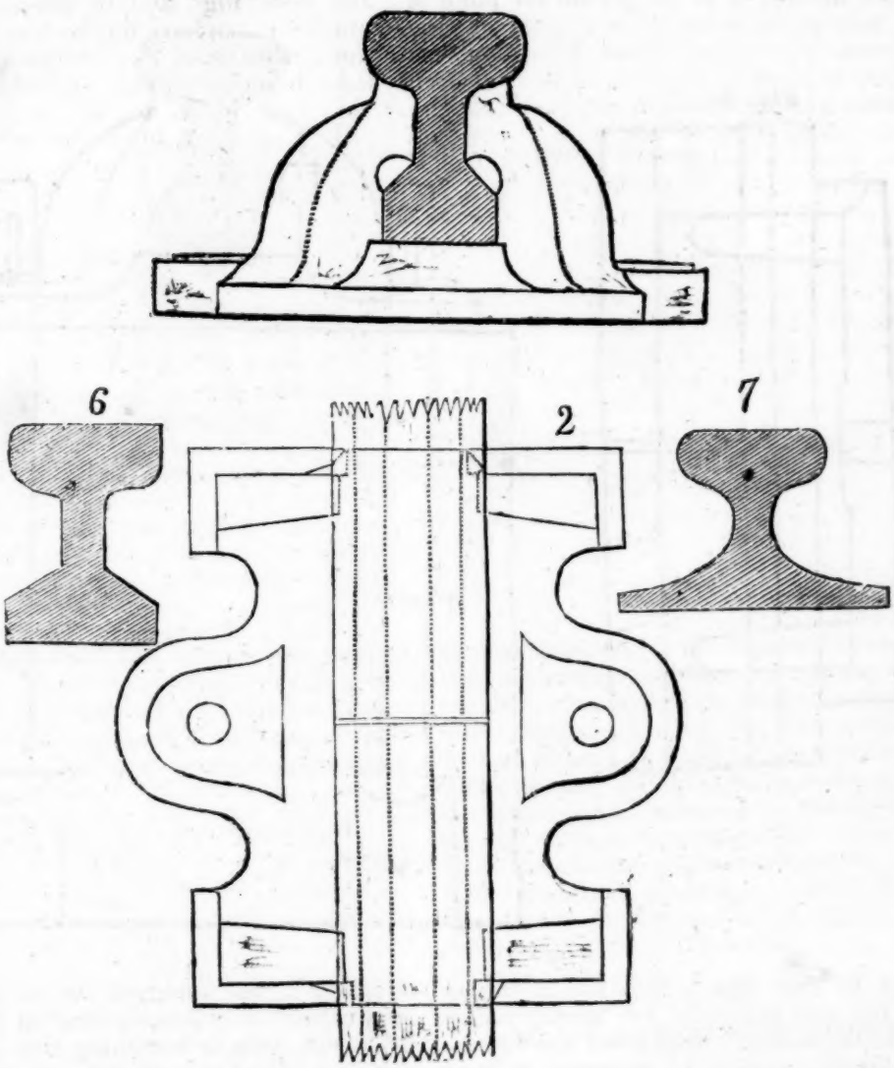
Mr. Barlow makes some very forcible observations, (which, in noticing his pamphlet, you have judiciously transferred to your pages,) on the importance of exact fitting and fastening; but to show you that all practical men have not been so indifferent to these matters as Mr. Barlow imagines, and indeed somewhat broadly insinuates, I will, with your leave, make another short extract from my letter to the London and Birmingham Railway Directors, which has an immediate bearing upon this part of the subject:

"I am quite sure a velocity of from 50 to 60 miles per hour may be obtained upon a well-constructed railway, with greater safety than one of 20 miles, upon any of the present lines yet in operation; not only from their having too tight a rail and ill-constructed pedestal, but from the mode of fixing them, *especially at the joints*, which is the great cause of so much deflection and sudden action, both vertically and horizontally—so that it is not in the power of man to make a locomotive engine to stand the action they are subject to long together.

"I have frequently stated to Companies, that every public railway ought to be laid down as accurate and as firm as it is possible for hands to do them; and, when that is done, to put a steam engine upon them to plane the surface, the same as we do our slide-rails."

I must also use the freedom to observe that, correct as Mr. Barlow's views are, of the importance of executing all railways in the best possible style of workmanship, he shows, in nearly all that regards the details, great want of practical knowledge. Speaking of keying the rails to the pedestals, he says, that "if the rails and chairs must not be permanently fixed to each other by direct means, it ought not to be attempted by indirect means, viz. by cotter keys or wedges, for either these will hold the rail to the chair, or they will not; if they do hold fast, they produce all the mischief which permanent fixing would occasion; and if they draw, then they do no good, although they may still do mischief." Now, if the Professor ever had an opportunity of carefully watching for a summer's day the passing of heavy steam carriages and long trains of other heavy carriages over a railway, he would never have ventured such a statement. He would have witnessed, that it is scarcely in the power of man to fasten the rails permanently to the pedestals. Aware of the impracticability of doing so, I do not allow the D key proposed by me, (see fig. 1,) when used to key the rail to the *joint*-pedestal, to be driven with more than a single-hand hammer; and I also stop it at its place when driven, the key being here merely intended to act as a steadiment to the rail. For before a locomotive engine or heavy train has passed twice over the rails, the whole of the

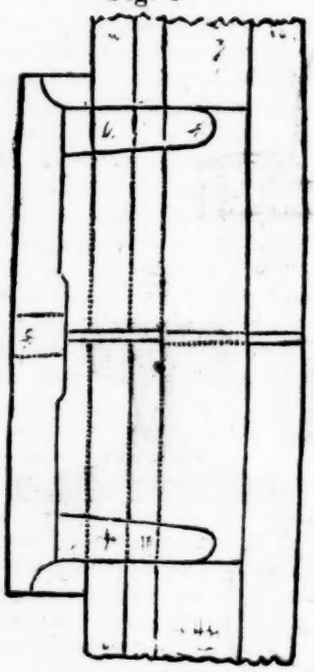
Fig. 1.



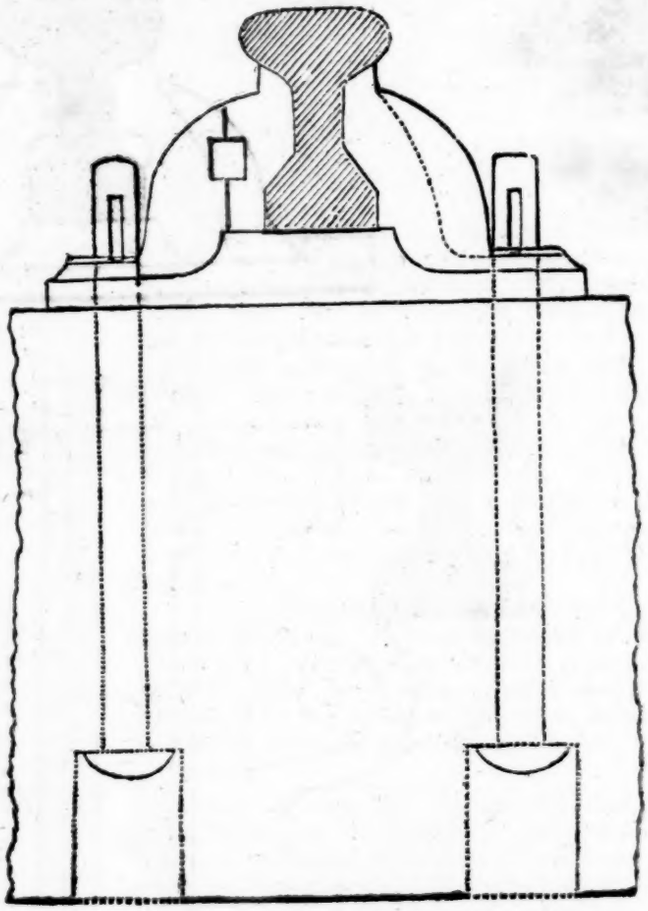
keys give or yield of necessity in such a manner as to allow the rails to expand or contract more than double what they really do, or are subject to, from the differences of temperature to which they are exposed. With respect, however, to the *intermediate* pedestals of the five-yard rails, the more soundly they are keyed to the rail the better, so as not to injure the pedestal by over-driving the key, as there is more latitude in the holes through the base of the pedestals where the bolts pass, than would compensate for treble the expansion and contraction the rails are subject to. Besides, each of the holes drilled through the stone blocks upon which the pedestals rest is drilled $\frac{1}{8}$th of an inch larger than the diameter of the bolts, and the pedestals can never be so hard cottered down to the surface of the stone but what they will give a little. All difficulties on this head I got completely over several years back, in both wrought and cast-iron railways, which have been laid under my direction. I could refer Mr. Barlow to several miles of railway which have been worked for years, and remain at present perfectly firm, without the least distortion, either vertically or horizontally.

Again: notwithstanding Mr. Barlow has actually proved by experiment that the parallel rail is superior to the parabolic, or fish-bellied rail, and has taken some pains to show the neutral axis, which has little or nothing to do with the best form of rail; yet he has forgotten to point out one of the most essential advantages which the parallel rail has over the parabolic rail, as I have frequently proved by the steelyard lever. I have found that by holding the ends of the rails firmly down, at the joint-pedestal especially, the parallel rail of fifty per yard will carry upwards of a ton more, with the same deflection, than they will do if the ends are

Fig. 3.



Fiig. 4.

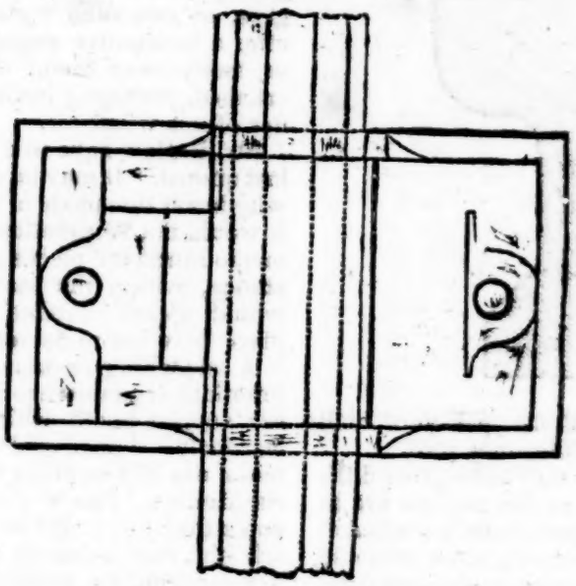


allowed to rise, which they will of course do if the end-pedestals are merely nailed down in the bad and ineffectual manner hitherto usual, namely, by common rails or spikes. When the rails are kept firmly down by proper means, the intermediate pedestals become so many fulcrums, and the tension of the fibres of the upper parts of the rail is called into play, as will be readily understood from inspection of the following diagram, in which AA represent the points of tension, and BB the points of deflection.

I perceive further from Mr. Barlow's experiments, that he considers the best rail for strength ought to be from $4\frac{1}{4}$ to $4\frac{1}{2}$ inches deep, from the upper to the lower surface. I am quite confident, however, that it will be found that the best form of wrought iron rail ought not to exceed $3\frac{3}{4}$ inches deep, or 4 inches at most; for by making the rail higher, not only will the pedestal be much weakened, but there will be no possibility of holding the pedestals firm on their base, by cotter bolts or any thing else, more particularly at the shunts and curvatures of the line of railway, and even the stone blocks will be continually shaken. It is well known in practice, that the lower any rail and pedestal can be kept, the less is the destruction in them, and the less the action on the foundation upon which the stone blocks are placed. It is also equally well known, that a sufficient wrought iron rail can be made of the depth I have stated, (namely $3\frac{3}{4}$ or 4 inches,) to resist the action of a locomotive of 12 to 14 tons weight, at a speed of 40 or 50 miles per hour, (or even more if necessary,) if it is properly laid and adjusted.

I find that the different railway companies are now going to have their rails manufactured to weigh as much as 60 lbs. per single yard. The additional 10 lbs. per yard ought, in my humble judgment, to be employed partly to strengthen the lower edge, and make it to rest more firmly on its basis, and partly to increase the width of the upper surface; both in the manner shown in fig. 6, which is a sectional view of what I con-

Fig. 5.



sider the best form of a rail of this weight. My object in these modifications is to increase the adhesion of the locomotive engines, as well as to give a little more bearing on the peripheries of their wheels, in order to make them last longer.

I understand the Directors of the Birmingham and Liverpool Railway (the Grand Junction,) have recently given an order for one or two thousand tons of parallel rails, the upper and lower edges of which are both alike; and that they have been induced to give this form of rail a trial by certain persons in their employment, who lay claim to it as *an invention of their own*, and put it off (naturally enough) as superior to all others. Now, the fact is, that twelvemonths ago, I gave one of their engineers a set of drawings, of rails and pedestals, of a variety of forms, *and this was one of them*. And in my letter to the Directors of the London and Birmingham Railway, before quoted from, I also expressly made mention of this form of rail, as one that *might* be employed, but pointed out, at the same time, certain objections to its use, which restrained me from proposing it for adoption. My words were these:

"I have hesitated with myself, whether or not to make a pattern with the upper and lower edges exactly alike, so as to be able to use either side, in case the former should prove a little unsound in any part, which has hitherto been frequently the case, especially at the ends, as I am fully aware that the more metallic material that can be brought to the lower side adds considerable strength to the rails; but as you seem disposed not to exceed 50 lbs. per single yard, a little would be lost in the depth and height of the rail. Allow me to assure you, that no public railway company will ever regret having sufficient strength in the rails at the beginning, and that they ought not, by any means, to confine themselves to a pound or two in the yard, in order to make the work as complete and substantial as possible at the commencement. But, as it is, after mature consideration, and taking every thing into question, I prefer the models I have furnished, (Nos. 8 and 3,) as the keys will be more effectual."

Fig. 8.

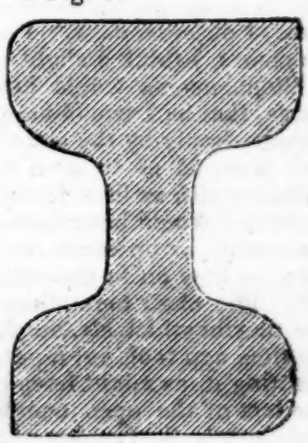


Fig. 8 is a section of the form of rail that I recommended, and would still recommend, for adoption, where it is desired to construct it, so that it may be inverted if necessary. It is what I call a "fancy rail," but ought to weigh at least 55 lbs. per yard.

Where a railway is intended for locomotive engines of only from eight to ten tons weight, a rail of the form represented in fig.

Fig. 9.

9, and weighing only 45 lbs. per yard, will be found to answer sufficiently well.

For America, where they have great difficulty in obtaining stone blocks, and are in the custom of fixing their rails on wooden sleepers of lengths varying from 30 to 50 feet, secured by cross sleepers, the best form of rail is that shown in fig. 7. I have been informed by American engineers that they can get plenty of a hard durable timber, very suitable for the purpose, for little more than the expense of cutting it down in the forests, and sending it to the saw mills to be cut into scantlings fit for immediate use; and that a railway bed of this description will last for nearly twenty years. Sometimes they lay their rails on cross sleepers only, dispensing with the side pieces. Several orders for rails of the form above referred to are now executing under my inspection for railway companies in America.

But to return to our own country: Mr. Barlow, I observe, says, "For the intermediate chairs, I think a slight modification of Mr. Stephenson's would best answer the purpose, that is, I would support the rail in the chair simply by the ends of two plain-ended pins, so as to give it the requisite steadiness with as little friction as possible. Of course I would have these pins pointing horizontally, or upwards, instead of downwards, as they do in the chair in the question." The chair here alluded to is, I presume, that for which Mr. Stephenson, *junior*, some time ago took out a *patent*, instead of submitting it, as might have been expected, to the test of the open competition, which his employers, the London and Birmingham Railway Directors, thought best for the interests of the public. As I have not myself seen any drawing or description of this chair, I am not prepared to offer any decided opinion upon it; but if its excellence consists (as Mr. B.'s language seems to indicate,) in supporting the rail "simply by the ends of two plain-ended pins," it must be one of the most inefficient of all the contrivances ever designed for the purpose. Mr. B. might as well make use of two of his fingers, as two such "plain-ended pins;" for after a locomotive engine had passed once or twice over them, they would be (not crushed, perhaps,) but rendered of no manner of use whatever.

Mr. Barlow says in a note to the passage last quoted, "It may be worth consideration, whether if this mode of fixing were adopted, it would not be practicable and advantageous to introduce pieces of felt, or other substance, within the seat of the chair, which would greatly subdue the jars that take place between metal and metal."

A crowning instance this, of the little practical acquaintance Mr. Barlow has with the subject about which he has written so learnedly. I have said that he might as well make use of two of his fingers as two of Mr. Stephenson, Jun.'s pins (if Mr. Stephenson's they be); and so I now take leave to tell him that as far as any benefit is to be derived from the insertion of felt within the chair, he might as well insert a piece of his thumbskin.

I will only, Mr. Editor, trespass further on your valuable space, to make another brief extract from my letter to the London and Birmingham Railway Directors, which contains a suggestion for the further security of the rails, that seems to me not undeserving of general attention:

"I should also advise, that each joint-pedestal should be coupled with the opposite one by an extended round bar of three-fourths or seven-eighths diameter, with a washer welded on each end, so as to drop on the ends of the copper bolts in order to keep the railway in true gauge. This I have found of great service even on common railways."

Trusting to the interest and importance of the subject for a justification of the length to which this letter has extended,

I remain, dear Sir, yours, respectfully,

ROBERT DAGLISH.

Orrell Cottage, near Wigan, May 26, 1835.

SCIENCE IN RUSSIA. — An uncommon effort is now making in Russia, to promote a knowledge of the natural sciences. This is the most extraordinary, when it is recollected that the imperial government has exercised an unparalleled hostility towards the only two universities of distinction in poor, degraded, miserable Poland, the victim of the most disgraceful barbarities that were ever practised in a civilized age. M. M. Push and Zeuscher, the professors of geology, whose high attainments would confer honor on any country, have been dismissed, and the cabinet of the former sold in Russia, in order to prevent the pos

sibility of having the higher departments of useful knowledge taught in territorial Poland.

At Irkutsk, in Siberia, that remote section of the world, where nature scarcely tolerates the existence of animal life, there is a gymnasium, which is furnished with an excellent library, and collections of minerals, rocks and shells, of great value. Count Cancrin, a philosopher as well as minister of state, has been a principal mover in the laudable efforts to enlighten his rough countrymen in the beautiful and sublime science of nature. Even Nicholas, intent as he seems to be in fettering the minds, limbs and property of his fifty-five millions of subjects, has sanctioned, since 1833, eight expeditions, of moment to the learned in all countries. Four of them were explorations of the Ural mountains, for the express purpose of obtaining a complete geological map of that singular and truly terrific region. North of these mountains, in the Trans-Caucasian district, where the auriferous sand, Glauber's salts, and volcanic soils, are predominant, the Russians have made themselves familiar with all the products which are regarded as important, by chemists or geologists.—[Scientific Tracts.]

Heat.—For a long time, philosophers have supposed that meteoric iron is made hot while traversing the atmosphere. A curious experiment was resorted to by M. Bierley, a foreigner, within a few months, which may possibly be of some service to those engaged in similar pursuits. A bar of iron, heated to whiteness, was held against a strong current of air from the blowing apparatus of a forge. Singular as it may seem, the bar, instead of cooling, burned very brilliantly, throwing off scintillations in every direction. The temperature rather increased than diminished. This experiment makes it very certain that a metallic mass, whirled through the upper regions of the air, would become extremely hot and eventually sparkle, as many meteors do just before they fall.—[Ib.]

Shooting Stars.—From the Transactions of the Geological Society of France, we learn that Professor Gruithuison is engaged in solving the problem of the true origin of aerolites and shooting stars. It is said, but on what authority is unknown to us, that he has proved, by mathematical calculations, founded upon physics, that those bodies must all be formed entirely above, and therefore beyond the earth's atmosphere, in space which astronomers technically call *interplanetary*, where the metals and metalloids are supposed to be held in solution by means of hydrogen, and where they exist continually for the formation of those singular opaque bodies.

Herschel was of opinion that shooting stars might be studied with reference to determining longitude. M. Quetelet estimated the meteors seen by himself to be between ten and fifteen leagues from the earth, and their motion at the rate of from five to eight leagues in a second of time. Several of the German philosophers have come to similar conclusions. The doctrine may, therefore, be considered as established, by the best of all evidence, that shooting stars traverse through an immense distance of celestial space, before they arrive near enough to terra firma to be recognized by the eye, even at the moment their brightness is rapidly dissipating.—[Ib.]

South Sea Island Tides.—Sir Isaac Newton's theory of the tides seems to be of little or no service in explaining the phenomena of high and low water in Polynesia. A host of evidence has been collected, establishing, beyond all manner of doubt, the fact that the tides at the South Sea Islands are scarcely any, if at all, influenced by the moon. The water rarely rises more than a few inches at any season of the year; and an unusually high tide at no time exceeds an elevation of one foot. But the most extraordinary circumstance in connection with these phenomena is this: during the whole year, without regard to the moon, it is invariably low tide at six o'clock in the morning, full tide exactly at noon day, and low water again at six in the evening. The true time is established and known altogether by the flowing of the water, at the islands. It has been suggested that this may be accounted for by supposing a suspension of the lunar tide-wave in the region where these beautiful, paradisaical abodes of once unsophisticated human nature are located.—[Ib.]

The Volcano of Popocatepetl.—M. de Gerotty, accompanied by two scientific companions, the last season, made an ascent of this very celebrated volcano, at the top of a huge mountain ridge, which bounds the great valley of Mexico, on the south and south-east. On this ridge, there are, in fact, two volcanoes, but the second, Iztaciuhatl, has not attained so much celebrity as the one under consideration, known by its Indian name of Popocatepetl. The crater, according to the account of our explorers, who have written a minute description to Baron Gross, chief secretary of the French Legation in Mexico, is an mmense abyss, nearly round, bulging towards the north, nearly a league in circumference,

and from eight hundred to a thousand feet in perpendicula. depth. The bottom of this awful furnace, as well as the inclined plane of its sides, is covered by innumerable blocks of pure sulphur. From the centre, masses of white vapor ascend with great force, but are dissipated about half way up the funnel. It was on this elevated summit, eighteen thousand feet above the level of the sea, that Don Diego Ordaz, one of the officers of Cortez, procured sulphur for manufacturing the powder used in the conquest of Mexico.—[Ib.]

VOLUMESCOPE.—Professor Hare, a celebrated chemist of Philadelphia, has invented an excellent instrument with the above name, which promises to be useful in the laboratory of every person devoted to chemical investigations. This instrument purports to be particularly for the analysis of atmospheric air, by means of nitric acid. He has also contrived an apparatus for obtaining the nitrogen from atmospheric air. It is truly delightful to hear that any thing is done in America to keep alive chemistry.—[Ib.]

LAUGHING HYENA. — The laugh of the hyena greatly resembles that of a maniac, and has a sterling effect as it steals through the still night, even under our windows, which it approaches in search of food. The power of imitation given to these animals is very extraordinary; for they not only cry like the quadruped whom they wish to lure within their reach, but they even seem to utter human sounds. The commandant of a fortress on the western coast of Africa assured a lady, that for several evenings he had been disturbed at his dinner hour, by the laughing and screaming of the native women, who passed under the walls in search of water. He sent his serjeant to them, who desired that they might take some other path, and they promised to obey. The next evening, however, the noise was heard again, which highly irritated the commandant, and he desired the serjeant to lie in ambush on the third evening, and rushing suddenly out on them, with a few soldiers, secure the women, and bring them to him in the fortress. The men took their station as ordered, the laughing recommenced, and out they sallied, when, to their great astonishment, they only saw three hyenas standing in the path which had been frequented by the women, and so well counterfeiting their voices, that they could not have been detected but by sight. These hyenas are not very formidable, and will, at any time, rather fly from, than attack a human being.

This species of the hyena are very common in American menageries, but they are so subdued and powerless, from constant confinement, and so fearfully watchful of the keeper's eye, that they never manifest, as prisoners, any of the peculiar imitative sounds which characterize them in their native regions.—[Ib.]

Report to the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. By M. DUFRENOY, *Engineer of Mines. Paris*, 1834.

(Continued from page 44.)

REMARKS UPON THE NATURE OF THE COAL EMPLOYED IN THE FURNACES USING CRUDE COAL.

It results from the preceding description, that certain coals, those of Wales, are employed in their natural state, for the fusion of iron ore in the smelting furnaces in which combustion is sustained by cold air.

That a great number of others — the coals of Glasgow, for example—are also susceptible of being used in the crude state, when the hot blast is employed; but that, for some varieties, the transformation into coke appears still to be indispensable, whatever be the plan on which the iron is made. To appreciate the causes which produce these remarkable differences in the properties of these coals, I have collected samples of most of those employed in the works spoken of in this report, which M. Berthier has analyzed in the laboratory of the School of Mines, and the results of which he has communicated.

Coal employed in the crude state in the Welsh Iron Works. Cold Blast.

	Dowlais.	Cyfartha.	Pen-y-danau.
Carbon,	0.795	0.784	0.768
Ashes,	0.030	0.028	0.032
Volatile matters,	0.175	0.188	0.200
	1.000	1.000	1.000

The coal of Dowlais is lamellar, separating across the layers in smooth and brilliant plates. This coal is composed of two distinct parts, one brilliant, dividing into small cubic fragments; the other, completely hard, fracture conchoidal, is nearly analogous to the Cannel coal.

These two varieties do not blend, but form in each strata small beds of greater or less thickness; the brilliant part greatly predominates. The Dowlais does not soil the fingers; it swells very little in coking, and does not cake; the ashes are perfectly white.

The *coal of Cyfartha* is rather slaty, or

lamellar, but is composed, as the preceding, of the union of the brilliant and compact black parts, intimately mixed, like the quartz and feldspar crystals in granite.

These two varieties of coal act very differently; that having a brilliant fracture swells and cakes sufficiently, whilst the dull kind is dry, and does not change by exposure to the fire. It is probably this mixture that gives to the coal employed at the Cyfartha works the property of resisting more than any other the action of the blast, and the different movements which take place in the furnace; its friability is also due to this circumstance; but the bitumen, which exists in sufficient abundance in the shining coal, cements the different parts of this coal, and gives it a great solidity after having been exposed to the fire.

The *coal of Pen-y-danau* has the same properties as the preceding, except that the mixture of the two kinds is less intimate. These three coals, belonging to the coal basin of Wales, are very dry, and owe this property to the excess of carbon which they contain; they are analogous to the coal of Rolduc.

Coals employed in a crude state in Furnaces worked with Heated Air.

		Environs of Glasgow.			Staffordshire.	Derbyshire	
		Clyde.	Calder.	Monkland	Tipton near Wed'y	Butterly.	Codnor Park
Carbon,		0.644	0.510	0.562	0 675	0.570	0.515
Ashes,		0.046	0.040	0.014	0.027	0.030	0.030
Volatile matters,	Water,	0.005	0.039	0.115	0.300	0.400	0.455
	Gas,	0.139	0.081	0 094			
	Tar,	0.166	0.330	0.315			
		1.000	1.000	1.000	1.000	1.000	1.000

The *coal of the environs of Glasgow*, employed in the Clyde, the Calder, and the Monkland works, present characters sufficiently marked, and of a composition very analogous, as seen by the preceding table.

This coal is usually dull, a little compact, hard, and does not crumble between the fingers; it presents, in its transverse fracture, a series of small lines, which gives a slaty appearance, though it does not, in reality, possess this quality. It is very well stratified, and the lumps cleave in flat fragments, of greater or less thickness; the surfaces of separation are almost always marked by black carbonaceous matter, which soils the fingers, and resembles charcoal in its fibrous appearance and dull color.

This coal is often traversed by extremely thin fillets of carbonate of lime, the direction of which is perpendicular to the layers, and sometimes pyrites is found.

The pieces of Glasgow coal submitted to analysis, softened but slightly; they cement together without change of form.

The *coal of Tipton*, which supplies the works of Lloyd & Forster, near Wednesbury, is slaty; it is composed of small beds, a few lines in thickness, separated almost always by an extremely thin bed of black carbonaceous matter, like charcoal. This substance is so abundant, that a piece of coal is rarely found at Tipton more than four inches thick, which does not present one or two layers of this friable material. This coal, shining in its fracture, divides into small pseudoregular fragments; it is slightly tenacious, and swells but little in coking.

The *coals in the environs of Derby* are divided into two principal qualities, designated under the names of *Cherry coal*, and *Soft coal*; the first, which is the harder, resists the action of the fire better than the second. The furnaces of Butterly, which use heated air, consume the Cherry coal exclusively; this coal is slaty, and presents lines of dull black, which gives it a strong resemblance to the coals of Scotland.

The soft coals, employed principally for steam engines and puddling furnaces, are used also, at Codnor Park, for the roasting of ores. This coal is shining, slaty, and separates in pieces by very light pressure; it contains some thin portions of black and friable carbonaceous matter, already alluded to.

Notwithstanding the considerable loss which these two coals sustain by coking, they scarcely change their form: they swell and cake slightly, and their ashes are perfectly white.

Coals that appear to require transformation into Coke, when employed even in Furnaces worked with Heated Air.

	Birtly Works, near Newcastle.	Tyne Works, Northumberland	Apdale Works, near Newcastle, Staff'dshire.
Carbon,	0.605	0.675	0.624
Ashes,	0.040	0 025	0 035
Volatile matters,	0.355	0.300	0.341
	1.000	1.000	1.000

The coal consumed at the Birtly and the Tyne Iron Works comes from the mines in the environs of Newcastle-upon-Tyne; it is shining, and splintery; it does not soil the fingers, nor does it crush by a light pressure.

This coal is, in general, very pure, containing no veins of carbonate of lime, or pyrites; it is very adhesive, and swells much by the action of heat, so that the value of the coke exceeds that of the coal employed. I am assured at the Tyne Works,

that they have tried in vain to work Newcastle coal in the crude state.

The coal of the *Apdale Works* is lamellar, shining and splintering in the direction of the strata; it divides into small quadrangular fragments; in the cross fracture, it presents large bands, perfectly smooth, and very brilliant. This is owing to the super position of small layers, of which the nature is a little different; this coal is very adhesive, swells in the fire, and gives a light, silvery, but very solid, coke.

If we compare the composition of the different coals that we have examined, we perceive—

1st. That the coals employed in a crude state, in the furnaces worked with cold air, are dry, very carbonaceous, and, in fact, true anthracites.

2d. The coals, as those of Scotland and Derbyshire, which, though bituminous, serve, in a crude state, for the fusion of iron ore in the smelting furnaces worked with heated air, are, however, still dry coals.

3d. Finally, the fat, bituminous, adhesive coals, which change their volume, and swell by the action of fire, appear still to require a transformation into coke, to give advantageous results in the smelting of iron ore.

QUALITY OF THE PIG IRON AND BAR IRON OBTAINED IN THE WORKS USING THE HEATED AIR BLAST.

The iron for castings in Scotland bears a less commercial value than that of Staffordshire. The first were quoted in the Liverpool market, in the month of July (1833) last, at 4*l.* 15*s.* sterling per ton, whilst the Staffordshire iron sold, at the same time, for 6*l.*

The difference between the price of these kinds, together with the prejudice generally entertained that the hot blast is unfit for the manufacture of iron, led some to doubt the advantages to be derived from the new method. The numerous observations I have made, tend, on the contrary, to prove that, for cast iron, at least, the products of the furnace working with heated air are superior to those of the cold blast. The less value of the Scotch iron is no evidence against this opinion. In fact, the Staffordshire iron has always been regarded as the most suitable for castings, and has always borne a higher price than that from most of the other parts of Great Britain; perhaps, also, the great difference in price between the Scotch and Staffordshire irons may be accounted for by commercial circumstances, for the Scotch now make iron much cheaper than others, and the production being increased almost one-third, by the employment of heated air alone, the iron masters have thought it to their interest to reduce the price of their iron, which they are enabled to do without loss.

It would be desirable if this important question could be decided by direct experiments; but for want of such, I will state the uses of these different products in the arts—uses which are, perhaps, as conclusive as experiments.

In the works near Glasgow, they make iron only for the foundry; I have seen the iron which they produce employed for the manufacture of castings, which require great strength and softness, to wit: steam engine cylinders, boilers, gas pipes, mill gearing, &c.

At Birtly, near Newcastle, and at Butterly, near Derby, I have also seen steam engine cylinders, pipes for water pumps, and fastenings for iron bridges.

I should state that the furnace of Torteron, at the Fourchambault works, in the Nievre, produces, since the use of this plan, gray iron, which competes in the market with that from England.

The iron manufactured from hot blast pigs is also of very good quality.

At Codnor Park, near Derby, this iron is employed in the constitution of different parts of the steam engine, of chains for suspension bridges, and of straps and cross-bars in iron bridges.

The iron produced at the Tyne works is wrought into sheets, for steam boilers, gasometers, &c.

At Wednesbury, the iron is also of good quality, and serves for purposes which require great strength.

These different examples prove that, by means of the hot blast plan, as well as by the old mode, superior metal can be made for foundry purposes, and which is well adapted for conversion into wrought iron; but it must not be thought that, by means of this plan, the faults which result from the nature of the ore, or coal, can be corrected.

PROBABLE CAUSES OF THE INCREASE OF HEAT, DUE TO THE USE OF HEATED AIR.

I have remarked several times, in the course of this report, that the temperature of the furnaces worked with heated air appears to be higher than in those where combustion is sustained by the use of cold air; all the indications which are usually considered as guides for the working of the furnace unite in proving this assertion.

The scoria does not attach itself above the tuyeres; the color of the fire, in this part of the furnace, is so white as to be injurious to the eyes; the scorias, which are very liquid, flow with facility; the metal being hotter, can be cast directly into the most delicate objects. The quantity of ore

in each charge is augmented in a great proportion, whilst the quantity of flux is decreased. This diminution in the proportion of melting is, of itself, the strongest proof of the increased temperature of the furnace; it indicates to us that the earthy matters find sufficient heat to fuse with a small addition of flux.

Probably it is to this excess of temperature that we should attribute the faculty of employing certain coals in a crude state, the transformation of which into coke appeared indispensable, at a less elevation of temperature.

In spite of these certain proofs of the increased temperature by the introduction of hot air into the furnaces, we cannot demonstrate its existence in a positive manner; but it appears to me that, to a certain point, a reason for this phenomenon may be given, by comparing that which passes in the furnace, by the constant introduction of air, to that which takes place by the mixture of two liquors of different temperatures, which we know will produce a mean temperature. The comparisons which I establish appear to me to be just, though the furnaces are in circumstances very different from the liquids having a given temperature, because the heat is reproduced without intermixture, by the combination of carbon and oxygen.

By admitting this cause of the augmentation of heat, it might be supposed to be very slight; on account of the great difference which exists between the temperature of the furnace, and that of the air which sustains the combustion; a difference that we have no accurate means of appreciating. I will show hereafter that this cause is not so feeble as might at first be supposed.

There is, I believe, another much more powerful cause, which it is impossible to estimate; it results from combinations, which could not be produced at the ordinary temperature of the furnace, and which are developed by the augmentation of heat due to the substitution of hot for cold air.

We see constantly, in our laboratories, examples of this phenomenon; substances which are acted upon slowly, and with much difficulty, by acids, at the temperature of the atmosphere, dissolved with facility when the liquor is slightly heated, and the combination formed often becomes itself a powerful source of heat. The operation of the smelting furnaces presents to us, perhaps, similar circumstances. The bitumen, and certain gases, which cannot burn at the temperature of the furnace using cold air, becomes ignited by the feeble augmentation of heat produced by the introduction of heated air; and the little smoke which passes out from the tunnel head when crude coal is consumed, and also the color of the flame, authorizes the belief that the bitumen, the hydrogen gas, &c., are almost wholly consumed.

This supposition naturally answers the objection that may be made, that, even admitting a certain augmentation of temperature by the introduction of heated air, there can be no diminution in the quantity of fuel consumed, because the diminished amount of fuel used in the furnace is compensated for by that required to heat the air.

We have stated that the quantity of air injected into the furnace could, by its great mass, have the power of cooling it to a considerable degree.

This mass of air was raised in the Scotch works, before the adoption of the hot air plan, to 2800 cubic feet per minute, weighing 214¼ pounds. The quantity of air injected in each day, therefore, may be estimated at about 140 tons.

The total amount of coal, mineral, and flux, does not exceed thirty-four tons; the weight of air, therefore, injected into the furnace, is more than four times that of the solid materials used in the same time.

We may conceive, therefore, that so considerable a mass, of which only a fifth part sustains combustion, thrown into the furnace at the mean temperature of the atmosphere, will produce a much greater refrigeration than when raised to the temperature of more than 600 degrees.

A circumstance which still tends to diminish, in a great degree, the refrigerating power of the air, by the use of the new plan, is, that the quantity of air is much less. In the furnaces of Scotland that we have taken for example, the quantity is reduced from 2800 cubic feet, to 2100 per minute, or twenty-five per cent.*

We can calculate the influence of the introduction of air upon the heat developed

* The specific heat of water being represented by 1.0000, that of the atmospheric air is 0.2669, from which it results that a gramme of air at 322° Cent., (612° Fah.) the temperature at which the air is injected into the Clyde furnace, would raise 0.733 gms. of water to 100°, (212° F.) supposing the air reduced to 10°, (60°;) and as the quantity of air introduced each minute is 124,770 gms., the heat which results from this mass is represented by 01,463 gms. of water, raised to 100°.

The charges at the Clyde works are now 34,416 kilogrammes of coal in twenty-four hours, or 23.00 kil. per minute, which, after deducting the waste by ashes, water, and gas, which escapes without being burnt, may be taken at a maximum of 20.30 kil.; the complete combustion of this quantity of coal would raise, in each minute, 1,465 kil. of water, from 0 to 100° centigrade; the increase of temperature which results from the temperature of the air at 322° cent., compared with that produced by the combustion of coal, would be as 92 to 1465, or one-sixteenth. This is the least ratio, the quantity of oxygen being insufficient to transform all the carbon into carbonic acid.

each instant, by the combustion of carbon; but it appears impossible to appreciate the augmentation which results from new combinations, caused by the combustion of the bitumen and carburetted gases, because we annot, in the present state of the science, estimate the temperature in the interior of the furnace; the few observations that precede, though not giving any idea of the real influence of the heated air, appear to me, at least, to establish that it is very considerable.

RECAPITULATION.

The details into which I have entered upon the greater part of the works using heated air, have, perhaps, prevented the reader from seizing the principal circumstances of the plan; I deem it, therefore, useful to recapitulate briefly—

I. In all the works, with the exception of one or two, its introduction has resulted in an increase of the products, an economy in the consumption of fuel, and of flux, as well as in the expense of labor, and incidentals.

II. These advantages have followed in the same progressive ratio as the temperature to which the air has been heated.

III. The production of metal has generally increased.

IV. The quantity of combustible matters burnt in the furnaces appears to be nearly the same where the heated air is used, as before with cold air; the daily consumption at the Clyde being eighteen tons of coke, to obtain six tons of metal; now it is eighteen tons of coal, to produce nine tons of metal.

V. The metal produced in the furnaces worked with heated air is generally gray, and fit for the foundry; nevertheless, this plan is employed with advantage in the works of which the pig iron is all, or in part, manufactured into bar iron, (Codnor Park, Tyne, Wednesbury, &c.) It is only necessary, for this purpose, to change the proportions of ore and fuel.

VI. In many works, the combustion requires much less heated, than it did cold, air; at the Clyde, for example, the same blast engine which served with difficulty for three furnaces, now blows four. The economy in motive force is not proportional to the diminished quantity of the blast, because a certain power is required to overcome the friction of the air in the heating apparatus, and the resistance which results from the expansion of the air by the heat. This last inconvenience is remedied by increasing the size of the tuyeres, their diameter having been increased from two and a half to three inches; the increased diameter of the tuyeres is also necessary to diminish the velocity of the current of air, when introduced into the furnace.

VII. When, as at Torteron, a diminution in the quantity of air does not result from increasing the temperature, additional power is required to move the blowing machine.

VIII. The substitution of heated for cold air, in the fusion of iron ore, is marked almost immediately by a change in the nature of the metal, which becomes more carbonized; the charges descend more slowly, but the working is accelerated by augmenting the proportion of ore.

Relative to the Apparatus:

IX. The apparatus formed by joining pipes of large diameter, which receive the air, and of small pipes, in which it is heated, and dilated, appears to me to be preferable to that composed of a series of pipes, of great diameter; requiring a smaller space, being less costly in the construction, and consuming less fuel than the last named; besides, the temperature is not uniform in all parts of this apparatus, and a current is usually formed in the centre, of diminished temperature.

X. To diminish, as much as possible, the velocity of the air submitted to the action of the heat, and to avoid the resistance due to its expansion, it is necessary that the surface of the small pipes should be more extended than that of the large pipe which receives the air from the blowing machine.

XI. The interior capacity of the small tubes ought to be greater than the volume of air injected into the furnace; by this disposition, the air remains a longer time exposed to the action of heat, and acquires a more elevated temperature.

XII. From this last condition, the apparatus placed on the trunnel head appears to be of but little advantage to furnaces using coal; sufficient size cannot be given to it, to enable the air to remain long enough; to remedy this evil, the air is made to pass over another fire placed near the tuyere.

Relative to the Fuel:

XIII. The coals, very rich in coke, which are dry, and resemble anthracite, can be employed in a crude state, in furnaces working even with cold air.

XIV. The coals which contain a large proportion of volatile matters, (30 to 35 per 100,) but which are not very adhesive, and do not change form during combustion, serve, without being carbonized, to work in furnaces using air heated to 300° Cent.

XV. It appears, finally, that fat and bituminous coals, like those of Newcastle, which are fit for the fusion of iron, must, even with the hot blast, be transformed into coke.

[From the Scientific Tracts.]

HOOP SNAKE.—The writer of the following article will please accept our thanks. It is by the accumulation of facts, however tri-

vial they may sometimes appear, that any permanent advancement can be made in natural history.

Brainerd, (Tenn.) July 8, 1835.

Dr. Smith—Sir: While looking over the tenth number of the third volume of the Scientific Tracts, I noticed a request for information respecting the 'horned serpent,' which, from the short description given, I presume is the same as what is called here the 'hoop snake.' While residing in New-England, I frequently heard marvellous accounts of this snake, as existing at the south and west, but was led to consider the account as fabulous, until recently. Two years since, at Haweis, then a missionary station, about fifty miles south of this place, on the Coasa river, occupied by Dr. Butler's family, where a school was in operation, while the children were out at play, at the foot of Turnip Mountain, some of the large girls discovered a snake making its way towards them, having the motion of a rolling hoop. They succeeded in killing it, and carried it to the house. Rev. Mr. Chamberlin, who was there, and Dr. Butler, on hearing the children say that it *rolled* after them, immediately concluded that it must be the hoop snake, and were led to make an examination. They easily discovered a sting in the end of the tail, about the size of a fine sewing needle, which, when the tail was pressed horizontally, would protrude itself about three fourths of an inch. The length of the snake was supposed to be eighteen inches. It was tolerably thick; its color, dark striped. Dr. Butler preserved about four inches of the tail in spirits, and took it to New-York last summer, from whence it was to be sent to Rev. David Green, at the Missionary Rooms, Boston, where, if it has been received, you will be able to examine for yourself.

The Cherokees say that the horned snake exists in the country, but is very rare, and is considered quite poisonous. While Dr. Butler was preparing the tail for preservation, he felt a severe nausea, which continued for some time. He considers his sickness occasioned by the influence of the poison from the snake.

Should you be able to examine the tail, and think that any thing I have written is worth publishing, it is at your service.

Respectfully yours,

J. C. Ellsworth.

African Serpents.—I never shall forget, (says Mrs. Lee, who has resided a long time in Africa,) the cold chill which crept over me, on first seeing a huge lizard crawling on the wall of my bed room; yet in time I not only was amused by the rapid movements of the large lizards, as they chased each other up and down the verandah where I sat, but I even fed them daily. A snake close to me, I thought would be death; but at last I became so careless about them, that, although there was a nest of deadly snakes in a hole in the wall, which it was necessary to pass, in going the shortest way to the kitchen, I used to watch for a minute or two, and then dart past, when they drew their heads in: a dangerous experiment, for they are very fierce when they have young ones. A battle between a snake and a rat was a curious sight, to which we were summoned by hearing, in the hall above the store room, a hissing and squeaking, for which we could not account. On opening the store room to ascertain the cause, a snake was to be seen rearing its beautiful many-colored neck and head, while a rat's black eyes were glistening with rage. They were in too great a fury to be disturbed by our approach, and flew at each other several times; at length the rat died in great agony, swelled up to a frightful size, and covered with foam. The snake was immediately destroyed by the servants.—[Ibid.]

The following excellent article on Female Education is from the "American Annals of Education"; and, although it is not addressed to "Apprentices," it may be of use to them to know how to select—for most of you will probably desire to select, when in a situation, a companion for life.

A *mechanic*, above *all other* men, ought to have an industrious, prudent, and economical wife—she should not only know how to govern her family, but also to govern *herself*. She, above all women, should feel and know that *home*, rather than the *streets* and *neighbors*, is *her proper place*. If therefore you would have such a companion, seek *not* for her where the mother is a *fashionable*, or one who spends more time *from*, than *at*, home.

FEMALE EDUCATION.

Domestic Habits.—In advising as to the course of early female education, I have insisted on the necessity of cultivating, in childhood, the habits of Temperance, Order, Activity, Industry, and Self-command, as essential to the health, happiness, and usefulness of woman.

There is another branch of female education of the first importance which involves many particulars, but may be termed the *preparation for domestic life*. This involves both *habit and skill in domestic employments*.

We must begin with forming domestic habits. No quality is more essential to the dignity of the female character; and without it there will never be patience in the acquisition of *domestic skill.* On the other hand, the domestic disposition is best cultivated by giving domestic employments. Useless objects and occupations soon tire us. Splendid furniture and ornaments, and mere amusements, produce a weariness, from which there is no escape, but by perpetual change. On this plan, how many families are made, not automatons, unfortunately, but *locomotives,* active only in vain and mischievous efforts for "some new things." As capable of happiness as their neighbors, they have never learned the true mode of enjoying it. They promenade the streets; they wander from shop to shop, from house to house, from street to street, gathering every subject for vanity or trifling, every secret or witticism, or report, they can find, to enlarge their supply of occupation for idle hours. Such "busy-bodies" always leave their own duties undone, or ill-done; and the habit of neglecting their own concerns necessarily leads them to occupy themselves with the affairs of others, and to interrupt them in their occupations, or interfere with their peace.

Let the daughter then be guarded against this pernicious fault. Let her be trained to feel, that her *first great duty,* when not engaged in the acquisition of useful knowledge, *is at home*—that she is her mother's natural assistant or substitute, in the care of the nursery, and the family. When she has well-learned the lesson of obedience and self-command, she may safely be entrusted with the direction of the other children, but not till then. Under the direction of her mother, she may, in this way, complete her course of training in self-government, and learn to imitate her heavenly father, who is "kind even to the evil and unthankful."

But she must also learn in the nursery that peculiar duty of woman,—the care of the feeble and the sick. Every family, and every child, are every day liable to accident and disease. Nothing in the nursery is so important as habitual care to prevent disease, and to relieve pain, or remove the cause at once, when it occurs. More can be accomplished to secure the health of children by the faithful, interested nurse, always present, than by the absent physician, however skillful, in occasional visits, which often prove too late to remedy the evil. This office, the elder sisters, and each of them, as they grow up, should be taught and accustomed to fill. For this purpose, she must acquire, not merely skill in watching and providing for the wants of her charge: presence of mind, gentleness of disposition, combined with firmness of resolution, are indispensable to the good nurse. These must, therefore, be cultivated and matured by constant practice. Daughters who are not trained in this manner can never be safely entrusted with the health of a family. Poor and pitiable matrons—still poorer and more pitiable, their companions, and their families!

But the nursery is not the only place for domestic duties and skill. Humble as the theme is, we cannot complete our view of female education without descending to the kitchen; for the table of the king himself must be furnished from it, and even the health of the family depends upon its right management. Order, and skill, and vigilance, must begin there, or comfort can never inhabit the house. She who governs it must learn in the only way possible—by acquiring practical skill in all that is to be done. This is an every-day business, not to be accomplished by one great effort, or by some wonderful plan, but by the regular, returning care of a directing eye, and a skillful hand. The mistress of a house becomes a pitiable cypher, if she has not the practical knowledge to direct the when, and the where, and the how, of every thing that concerns her family affairs; and she can learn this only by experience. Respect is paid to authority, only when those who exert it know how to give directions in the right time, and the right manner.

Let the daughter, then, as much as possible, learn every part of household duty, practically. It was a wise step in a circle of ladies in one of our cities, to finish the education of their daughters in a cookery school. They attended punctually, and daily, for a certain number of hours, long enough to give them a competent and practical knowledge of the arts and the economy of the kitchen. Their works praised them; and the convenience and pleasure of a well regulated, economical, and healthy table was the reward of their efforts. Regularity and order prevailed in every department of the house, because the whole was directed with intelligence and skill. The incessant causes of scolding, and fretfulness, and discontent, were in a great measure removed, by the training which not only gave these matrons habits of industry and self-command for themselves, but taught them how to direct the employments of others with regularity and success.

In visiting the house of Mrs. ———, every one is ready to ask, "How could you bring your family to this regular, quiet, pleasant state?" The simple answer is, "by understanding what every one ought

to do, and how it ought to be done, by beginning right and persevering in the right course, until every one knew her duties, and could do them well." A course of actions will form a habit; and habit, we know, is second nature. In this way, hard things become easy, and labor pleasant. Idleness will be at length painful, and fretfulness intolerable. It will be easier to do right, than to resist the steady current of order in the family; and every disturber of the peace will be frowned upon, as an enemy of the whole.

And while I am urging this duty, I cannot help alluding to the sad neglect of it in modern days. What is to be the history of the rising generation? Must it be told in language like this?

"Fashion and accomplishments, and amusements, and unnecessary display in literature and science, absorbed the whole time of the females of this period. Domestic cares and virtue seem to have descended to the tomb with their grandames, or to be consigned with their pictures to the garret. Their domestic skill was lost, and their domestic habits forgotten or despised; and when the tale was told by some relic of former days, or appealed to as an example, it was only met with a suppressed smile at such antiquated notions, or an open scoff at those who busied themselves at home in ignorance, or submitted to be slaves to their husbands and children. The immediate consequences were such as might be anticipated. The wealth which industry abroad and frugality at home had accumulated, was scattered by indolence and ignorance, and prodigal expense. The noble dwellings which it had raised and furnished, were sold to pay the debts of extravagance, or pulled down to make way for others, which soon shared the same fate. Many a mechanic, who grew rich by the obsolete virtues of industry and economy, occupied the splendid house of those who looked down upon him, and despised his virtues; and his daughters held the first station in society, while those of his employer might be found in some obscure corner, with little to cover them but worn-out finery, and apparently with little to sustain them but their pride in what they had been. Nay, the domestic was often to be seen taking the place of his master, and occupying the station from which his children had fallen, by the neglect of forming domestic and industrious habits in their education."

Whether this shall be the record of the whole generation or not, such is, unhappily, the history of many a family, and is likely to be that of many more. Perhaps I shall not even obtain a hearing from those who have already begun this course. The whirlpool seldom permits any to escape who have once entered, even its margin. But those who are approaching it may, perhaps, hear me; and I warn them, that they guard against its powerful current before it is too late; for I have witnessed more examples than I can mention, of its ruinous effects.

I am aware that economy and its attendant train of minor virtues are *old fashioned* matters. They are found in here and there a family; but the very names seem rather to belong to the dictionaries of the last century. But there is a section in an old book, too seldom studied —the last counsel of a wise man—which recommends them; and as it describes particularly the virtues and the defects of women, it ought to be often read by mothers and daughters. Although not new, its very antiquity, I trust, will give it authority with most readers; and in addition to other salutary truths, they will learn that in female education, and in female duties above all things, "the fear of God is the beginning of wisdom." SENEX.

FARMERS AND MECHANICS.—Miss Sedgwick, or one of the Misses Sedgwick—for there are three of that name who have appeared in print—have just issued a new work from the press of Messrs. Monroe & Co., of Boston, entitled "Home," and dedicated to the Farmers and Mechanics. The sentiment conveyed in the following appropriate language is no less just than true. One of her characters charges her neighbor with the intention of educating his sons for the learned professions, and his daughers for the wives of professional gentlemen, to which the latter thus sensibly replies:

"I shall be governed by circumstances; I do not intend or wish, Anthon, to crowd my boys into the learned professions. If any among them have a particular talent or taste for them, they may follow them. They must decide for themselves in a matter more important to them than any one else. But my boys know that I should be mortified if they selected these professions from the vulgar notions that they were more genteel—a vulgar word that ought to be banished from the American vocabulary—more genteel than agriculture or the mechanic arts. I have labored hard to convince my boys there is nothing vulgar in the mechanic profession—no particular reason for envying the lawyer or the doctor. They, as much as the farmer and mechanic, are working men. And I should like to know what there is particularly elevating in sitting over a table and writing

prescribed forms, or in inquiring into the particulars of diseases and doling out physic for them. It is certainly a false notion in a democratic republic, that a lawyer has any higher claim to respectability—gentility, if you please—than a tanner, a goldsmith, a painter, or a builder. It is the fault of the mechanic, if he takes the place not assigned to him by the government and institutions of his country. He is of the lower orders, only when he is self-degraded by the ignorance and coarse manners which are associated with manual labor in countries where society is divided into castes, and have therefore come to be considered inseparable from it. Rely upon it, it is not so. The old barriers are down. The time has come when 'being mechanics,' we may appear on 'laboring days' as well as holidays, without the 'sign of our profession.' Talent and worth are the only eternal grounds of distinction. To these the Almighty has affixed his everlasting patent of nobility, and these it is which make bright 'the immortal names' to which our children may aspire as well as others. It will be our own fault, Anthon, if, in our land, society as well as government is not organized upon a new foundation. But we must secure, by our own efforts, the elevations that are now accessible to all."

Manual Labor Schools.—We consider the man who first introduced this important system as a public benefactor—and entitled to more credit for his services than if he had conquered a nation.

If "he who makes two ears of corn, or two blades of grass, grow where only *one* grew before, deserves better of mankind and his country, than the whole race of politicians put together," how much more does he deserve, who points out a way by which two young men, destitute of means, according to *previous* opinions and practice, can, where only *one* was before enabled to, acquire an *education*, and thereby contribute to the education of others, and to the general diffusion of knowledge?

Not that a young man is *now* enabled to do more than he could have done if he had only been so convinced of the fact; but it is by having pointed out the *method*—and by convincing young men of their *ability*, to support themselves, every day, by their own exertions, without interfering with their studies, which is so creditable to its author—as now every young man who has learned a trade may by that means readily acquire a collegiate education, by his own labor, and be none the less, but actually much more, respected for the manner of acquiring it.

Manual Labor in Waterville College.—From a recent statement by President Babcock, of Waterville College, Maine, it appears that the manual labor department of that Institution is remarkably successful.

"Considerably more than one half of the whole number of students in College are regularly engaged in labor (chiefly in the College shops) three hours a day. Their earnings vary from 50 cents to $2 50 cents per week, according to their skill, strength, and diligence; but on an average they pay for their board by their labor. This system of labor has been in successful operation for more than two years, (with the exception of a few weeks last autumn, when the scarcity of lumber partially suspended work in the shops,) and the results of it are no longer doubtful. The regular exercise thus furnished is found highly conducive to health, and to intellectual vigor. No student is hindered in the successful prosecution of his studies, by employing three hours a day in work. The good order of the College is also essentially promoted by this kind of employment of the leisure hours of so large a portion of the students."

He gives the following reasons why this plan has succeeded better there than in many other institutions.

"A large proportion of our students are able-bodied men, who have been accustomed to labor, and do not regard it as dishonorable. We have an excellent and popular superintendent of the shops, at a reasonable charge. The shops, tools, &c., have been furnished by contributions for the purpose, and only need to be kept in repair by a small tax on the occupants. We have also unusual facilities for purchasing lumber, and disposing of work of various kinds from the shops. By carrying the principles of the division of labor into effect, the several processes are so simplified, that young men, of common ingenuity, if they have never before been accustomed to the use of tools, very soon learn to work to good advantage. The low price of board and tuition (only $1 a week for the former, when paid in advance, and $20 per annum for the latter,) are an encouragement to many worthy young men, thirsting for the advantages of education, to endeavor to procure one here chiefly by their own efforts."

It is also stated that individuals of proper

age, who do not pursue the regular course, are allowed to reside in the institution, and are permitted to engage in any studies they may choose.—[Am. Annals of Education.]

Locomotive Power of Oysters. — The Abbe Dicquemere endeavored to show, and pretty satisfactorily too, that the oyster can perform various locomotive movements, perfectly corresponding to its wants, to the dangers it apprehends, and to the enemies by which it may be assailed. If an oyster is taken from a locality which is always covered by water, and placed in one where there is an ebb and flow of the tide, having had no experience on the recession of the sea, its shell is thrown open, regardless alike of the destructive tendency of solar heat or violent assaults of enemies. On the other hand, placed in a similar condition to its original abode, there seems to be a conciousness of the change, as fear induces it to press the valves closer than ever, till a familiarity is established with the condition of things in the new and unexplored region to which it has been carried. This argues an approximation to mind. Indeed, if it is not elementary intelligence, something a little beyond the mere force of instinct, what is it? There is a plain indication of both sensation and distinct perception.

Oysters are furnished with a cylindrical organ for propelling a little stream of water with considerable force. By this syringe, for in effect it is one, inasmuch as it acts upon the same principle, sea worms, gravel, and other equally offensive intruders within the shell are suddenly resisted at the margin, or washed out, if once entered, by this simple yet indispensable contrivance. By an instantaneous ejection of the contents of the tube against the water by which they are surrounded, if not firmly wedged between rocks, or to each other, they can change their position, and vary it to suit their further convenience from time to time. Thus the activity they sometimes discover in going backwards or forwards, magically as it were, there being no limb protruded by which a hold can be taken upon the bottom, wholly depends on their syringe. Any one can experiment to his own satisfaction to understand the locomotive ability of the oyster, by placing two or three of them horizontally on a plate, with just water enough to cover them.—[Scientific Tracts.]

Sand Capes.—On walking over sandy beaches in this vicinity, from the first of June till the approach of the autumnal frosts, an immense number of somewhat saucer-shaped cups of sand are found everywhere scattered, from high to low water mark, varying in size from half an inch to six or eight inches in diameter. From the circumstance that they resemble a lady's cape, as nearly as anything to which they can appropriately be likened, they have received the significant name of *sand capes*. Particles of sand, side by side, are glued together so firmly that considerable force is required to tear the broad ribbon which is presented, when the cup or cape is spread out into a flat or nearly flat surface.

The question has recently been agitated by an editor of a daily paper in Boston, who was struck with the singularity of their appearance on the famous Nantasket beach, what produces them? He seemed to suppose the sand was rolled into that particular form by the action of the waves.

Having carefully investigated the subject, we are able to solve the problem. They are the architecture of the *Natica heros*, the common cockle, or sea snail. Some are as large as a turkey's egg; and others, according to their age, are quite small. The object of these capes is protection from the solar heat, when the tide leaves the animal. It rarely happens that the snail manufactures a cape at any other time than in the forenoon, when the sun pours down its intensest heat. The snail, just under a thin covering of sand, throws out of a secreting organ, just within the gyral lip of its shell, a thick, glairy fluid, resembling the white of an egg. It then instantly begins to roll over, which spreads the gluten over its whole surface, to which the sand adheres. As the shell comes right side up, the sand cape is beautifully fabricated, and almost instantly hardens. The gluten is perfectly insoluble in water, and therefore resists, for weeks, the combined action of winds and waves, after being abandoned by the snail. Under this curious protection, the animal protrudes itself above the surface, and travels about under it in search of food. Though their progress is slow, we have seen them protrude their tentacula, fearlessly, engaged in reaching from under the edge. As soon as the tide returns, the cape being no longer necessary, it is overturned, and washes away. We saw one made, the other day, by a snail purposely exposed to the burning rays of the sun. As soon as it was completed, we took it adroitly off. The want of it was obviously felt, for another was commenced directly. We have several prisoners at this time, each one being driven to manufacture a sand cape at our pleasure.

But as nature allows nothing to be wasted, being an economist in everything, the cast off cape becomes an important auxiliary to another class of almost unnoticed aquatic beings. Shrimps, prawns, sand bugs, and

even barnacles, take possession of them, if they happen to remain any considerable length of time right side down. Being slit open upon one side, like the lip of a screw auger, these little animals slide in at the breach, and concealing themselves under the shade of the cup, there wait the entrance of still smaller creatures, on which they voraciously prey. The barnacles, particularly, stick on a vast quantity of eggs, in regular rows, which increase very rapidly, under the alternate influence of sunshine and water.

Were the glue of which we have been speaking collected in vials, an easy matter, by compressing the organ in which it is elaborated, it would be found the best article for mending glass vessels in the world. Water does not soften it, and being, probably, only soluble in high wine, it might be made an important article in domestic economy.—[Ib.]

Checks and Balances.—In the marshy sections of equatorial regions, where the jointed canes grow to an immense height, there also abounds a species of ant, that makes an entrance near the root, and gnaws its way through the whole series of joints, till it arrives at the top, where it remains till the periodical rains have subsided. Without this particular vegetable production, the ant would be drowned, as the peculiarities of its organization and construction require that it should live where stagnant waters abound. While the ants are preserved by wending their way up the hollow reeds, they cause the death of the plant, which, becoming dry, is in time overcome by the winds, decays, and thus furnishes soil for the nourishment of other plants.

This same provision is discoverable throughout the globe. Nothing is immutable. However beautiful or useful, or however complicated, nothing can remain at rest. Matter is continually and necessarily assuming new forms, and acquiring new properties. Some tribes of beings seem expressly created for the destruction of others, so that the whole physical condition of the earth is forever undergoing changes. This law contributes to the vigor, health, and utility of the whole.—[Ib.]

A Domesticated Panther.—Mrs. Lee, to whom we are indebted for many curious illustrations of the character of African animals, speaking of a domesticated panther, says:—

"He came from Coomassie with Mr. Hutchinson, the resident left there by Mr. Bowditch, and, as he was very young, the efforts made by that gentleman and others to tame him were completely necessary. Nothing alive was ever given him to eat, and so well was he trained, that frequently on their march to the coast, when the natives would not contribute any provisions, he would catch a fowl, and lay it at the feet of Mr. Hutchinson, who always rewarded him with a select morsel. On arriving at Cape Coast, he was tied up for a few days with a slight cord, and after that, remained at liberty, with a boy to watch that he did not annoy the officers of the castle. He especially attached himself to me and the governor, probably because we bestowed more caresses on him than any one else; we took care, however, to keep his claws well filed, that we might not get an unintentional scratch. He was as playful as a kitten, and a few days after his cord had been taken away, he took it into his head to bound round the whole fort. The boy ran after him, which he mistaking for fun, only increased his speed, and caused him to dash through all the narrow spaces. Most of the inhabitants were frightened out of their senses, and it was highly amusing to see the sudden disappearance of all living things, even to the sentinels. When tired, he quietly walked in at my door, and his pursuers found him lying on the ground, beside me, composing himself to sleep, whence he was taken without the least resistance. * * Sai's chief amusement was standing on his hind legs, resting his fore paws on the window-sill, and fixing his head between them, in this posture to contemplate all that was going on in town below. The governor's children, however, often disputed this post with him, and dragged him down by the tail, which he bore with perfect good humor. * * An old woman, who always swept the great hall before dinner, was performing her daily office with a small hand-brush, and consequently going over the floor on her hands and knees. Sai, who had been sleeping under one of the sofas, suddenly rushed out, and leaping on the woman's back, stood there with his head on one side, his tail swinging backwards and forwards, the very personification of mischief. * * The governor and myself, hearing the noise, also came to the scene of action, when Sai descended from his station, and held his head to us to be patted, as if in approbation of his feat.

The time came for him to be embarked, and he was shut into a large, strong cage, with iron bars in front, and put into a canoe; while there, the motion made him restless, and he uttered a howl, which so frightened the canoe men, that they lost their balance, set up a howl in echo, and upset the canoe. We were watching his embarkation from one of the castle windows; and when we saw the cage floating on the waves, we gave our pet up as lost; and I am not sure that we did not make a trio in the cry; but fortunately a boat immediately put off from the ship, the men in which caught hold of the cage just as it was on the point of sinking. The panther was installed close by the foremast, and I did not fail to pay him a visit the moment I went on board. He was very dull, and, perhaps, a little sea-sick, but was half frantic with joy on seeing me.—[Ibid.]

On the Obstruction of Cast Iron Water Pipes, by the formation of Nodules of Oxide of Iron within them. By M. Payen.

[Translated for the Journal of the Franklin Institute, by Jos. Wharton, at the request of the Committee on Publications.]

A singular effect has been lately observed to take place by use in cast iron water pipes, in certain cities. The passage of the water becomes gradually obstructed, by the formation of nodules of impure oxide of iron, of a light brown or greenish color, which adhere to the internal surfaces of the pipes.

This subject being one of the greatest importance in connection with the health of cities, and the agriculture of various districts, required an elaborate investigation, which I undertook, and of the results of which the following is a succinct account.

All soluble substances that give an alkaline reaction to water, such as potassa, soda, ammonia, and lime, the carbonates of potassa, of soda, and of ammonia, the borate of soda, and the sub-acetate of lead, are capable of preventing the oxidation of iron.

The relative proportions of these substances, and of the water, required to produce the effect, varies with the alkaline agent employed, and is also affected by the presence of certain foreign salts; the alkaline agents being the same, the nature and quantity of these salts determine the proportions.

When the quantity of alkaline matter is insufficient, oxidation ensues; but it is remarkable that all the points of the surface are not, in this case, equally oxidized, so that the nodular form of the concretions must be assumed from the beginning. The preserving force is overcome only in places where the continuity of the surface has been interrupted, even although it be by an almost imperceptible division. Thus, for instance, the lines on fibrous iron, and the points where the parts of the iron are separated by foreign bodies, are oftentimes pointed out by traces of greenish oxide, which gradually fill up, while the rest of the surface preserves, for a long time, its metallic aspect; and hence the advantage of an iron as *mechanically* pure as possible. The points of contact between a connecting pipe, and the sides of a main, or between two pipes, are likewise sufficient to determine the effect.

The following are a few experiments upon these points.

A cylinder of polished iron, immersed in a saturated solution of pure potassa, diluted with 1000 times its volume of water, (the temperature being 59° Fahr.) was preserved untarnished for a long time; but as the carbonic acid of the air gradually weakened the intensity of the alkaline action, signs of oxidation began to exhibit themselves at various points, and became more and more apparent, while the greater part of the surface preserved its lustre after the lapse of a year.

Conical concretions of oxide were gradually formed on the surface of an iron cylinder, when the latter was immersed in water containing 0.02 parts of its volume of a saturated solution of carbonate of soda. The color of these concretions was a greenish brown, which acquired a yellowish cast at their summits, while the base in contact with the metal retained its original greenish brown color. The liquid was not protected from the air.

The same saturated solution being used, but diluted with fifty-nine parts of water, and kept for a year, in an open tube, in contact with polished cylinders of iron, greenish concretions were first

formed, which slowly passed round the cylinders, and gradually assumed a beautiful yellow tint, whilst the rest of the surface, even of that part which, by the evaporation of the liquid, was uncovered, preserved its metallic state. In the same circumstances, the iron has been completely preserved from oxidation in water containing 0.023 of a saturated solution of carbonate of soda.

In a saturated solution of chloride of sodium,* protected from the air, there appeared, on the surface, and, it is to be particularly observed, *on the points of contact* between several bars of iron, only some protuberances of greenish oxide, the remainder of the surface preserving its metallic lustre after the lapse of a year. In a similar experiment made in contact with the air, the oxidation continued, and assumed the color of rust, beginning with the parts nearest the surface of the liquid.

A solution saturated with marine salt, and carbonate of soda, preserved iron entirely from oxidation, for the same space of time, notwithstanding the presence of atmospheric air, and a crystallization of a part of each of the two salts.

The same solution, diluted with nine volumes of water, afforded concretions of oxide.

In endeavoring to obtain, in accordance with the above experiment, the exact proportions of water, of chloride of sodium, and of carbonate of soda, the most favorable to the formation of local concretions of oxide, I found that a saturated solution of the two last, (the solution being made at the temperature of 59° Fahr.) diluted with seventy-five times its volume of water of the Seine, (see note 3,) and filtered, produced, in less than a minute, an oxidation both on wrought and cast iron. The effect was first shown by the appearance of points of a pale green; in ten minutes' time, the lines were well defined.†

When, in compliance with a suggestion of M. Becquerel, the power of electric conductibility was increased, by bringing, by means of a wire, a fragment of well calcined charcoal into contact with a polished bar of wrought or cast iron—the other circumstances being the same as in the preceding experiment—the greenish protuberances were developed still more rapidly, and in much greater number.

In weak alkaline solutions of the same substances, freed from atmospheric air, oxidation does not ensue.

In those containing atmospheric air, oxidation is arrested when the access of the exterior air is prevented.

When the air of the atmosphere has free access, the concretions nearest the surface pass into a higher state of oxidation, while the greenish oxidation continues, at other parts of the surface, on the points at which it began.*

The figure of the concretions is sometimes irregularly rounded, sometimes conical, and, at times, variously ramified into winding bands.

Bars of wrought and cast iron, polished, which have been, for the last four days, immersed in water, that had previously stood in contact with a portion of white marble, in the form of a well washed powder, already exhibit, near the surface of the liquid, points of a greenish oxidation, and rust in a floculent state.

The following conclusions may be drawn from the preceding facts, and others not mentioned.

1. That all solutions, having a slight alkaline reaction, may, while the general surface is preserved, occasion the formation of local concretions of oxide, at certain points of the surface of iron immersed in them.†

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* (1) In making a saturated solution of chloride of sodium, in water of the Seine, the liquid suffered a contraction equal to 0.03 of its volume, and disengaged 0.015 of the same volume, of gases contained in the water. The temperature was 59 Fahr., and the pressure 30 inches.

† (2) The chloride of sodium, when present by itself, in small proportions, in water, determines, on the surface of polished iron, local oxidations, which remain greenish colored the longer, and preserve the remainder of the surface the better, accordingly as the iron is farther removed from the surface of the liquid in contact with the air; but these oxidations do not assume the nodular form.

* (3) In all the preceding experiments, made with a view to their practical application, the water used was taken from the river Seine, and filtered after its mixture with the alkaline solution, and the subsidence of the precipitate, (which fell in consequence.) The temperature during the experiments varied from 59 to 62.6, and from 68 to 69 8, Fahrenheit. Several of these experiments, repeated with the use of distilled water, gave the same results, when the proportions of the alkaline substance, of the atmospheric air, &c., were the same.

† (4) Wrought and cast iron, half immersed in a weak ammoniacal solution, were preserved, by the

That the general character and rapidity of this process varies with the presence, and according to the proportions, of atmospheric air, and different salts, that may be brought into action, and is further determined by the presence of breaks in the continuity of the surface of the metal immersed, whether these interruptions exist in a single piece, or at the lines of separation between different pieces of iron, or even between the latter and other substances.

3. That acid solutions determine a uniform, and less bulky, oxidation; on copper, both acid and alkaline solutions determine a general oxidation.

Local concretions must then be expected to ensue in wrought or cast iron pipes, when exposed to a current of water slightly saline, and having a feeble alkaline reaction. In such case, it will be necessary either to abandon the use of this metal, or at least to contrive convenient places of access to the pipes, at short distances from each other. In this case, owing to the minute state of division of the particles, and the granular formation of the concretions, the obstruction may be removed by the application of a gentle friction, or by the assistance of a diluted acid, too weak to injure materially the metallic parts.

Note by the Translator.

The general properties developed in this paper, as belonging to all alkaline solutions, are considered by the author to present a new series of electro-chemical actions to the attention of the scientific chemist.

[From the Journal of the Franklin Institute.]

Remarks in relation to some new Concretions, produced artificially on Iron. By M. Payen.

In a recent paper, the results of which have been verified by M M. Becquerel and Dumas, I made known a method of forming the protoxide and peroxide of iron, in the shape of nodular concretions, on certain points of the surface of iron,* while the remainder of the surface preserves unchanged its metallic state.

An investigation, having its origin in the electro-chemical theory, and the properties of alkaline solutions, has led me to the discovery of another kind of local concretions, produced by a series of still more complicated reactions.

A polished cylinder of soft iron was kept immersed, for a year, in a close vessel, in a solution of sub-acetate of lead, and consequently exposed to the influence of an alkaline reaction; for a short period, no signs of oxidation were observable, but it afterwards became studded with a number of spongy, greyish excrescences, which presented themselves on a line parallel to the axis, (see preceding paper.) The remainder of the surface of the iron preserved, unaltered, its original appearance.

The concretions were made up of small particles, aggregated in the form of a metallic sponge, that presented the appearance and ductility of lead.

A slight friction was sufficient to unite the particles when separated, and to give the mass the brilliancy of that metal.

When flattened together under a slight pressure, and heated in a tube out of contact with the air, they melted, and hardened, on cooling, into a dross, that possessed all the properties of lead.

The liquid itself remained limpid and colorless throughout the year; afterwards, when exposed to the air, it quickly assumed a yellowish brown color, which gradually deepened; it still possessed a feebly alkaline character.

A portion of the liquid being treated with sulphuric acid, acetic acid was developed. Another portion, by the action of a soluble sulphate, gave a precipitate of sulphate of lead, and the supernatant solution had all the properties of the salts of iron.

The tube in which the solution, and the immersed iron, were enclosed, contained, then, evidently, the following substances, present, at the same time, together.

1, sub-acetate of lead; 2, metallic iron; 3, lead, in the form of a concretion; 4, acetate of iron, partly acetate of the peroxide.

It appears to me to follow, from the preceding facts, that, at the points where, by the presence of foreign bodies, and in-

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vapor of the ammonia mingling with the air above the liquid, during all the variations of temperature throughout the year. The solution contained 0.1 of ammonia. All the above mentioned concretions are composed of a mixture of hydrated protoxide and peroxide of iron; the proportion of the latter slowly increases.

* The preceding paper is the one referred to by the author.—[Translator.]

terruptions in the continuity of the surface, the elements of a pile are constituted, the iron is oxidized at the expense of the oxide of lead, the latter metal being revived, and aggregating in concretions, at the same points, while the oxide of iron, united to its equivalent of acetic acid, diffuses itself in the liquid.

By the continuance of the same series of reactions, the volume of the concretions is augmented, while, by the alkaline reaction of the undecomposed sub-acetate of lead, the rest of the surface of the iron is preserved from oxidation, and is thus enabled to maintain its metallic lustre.

[From the Scientific Tracts.]

A LETTER TO DR. FRANKLIN, BY A SEAMAN, MANY YEARS AGO.—I have often wished that somebody would carefully collate a sufficient number of meteorological journals, with intent to observe and class the several appearances in the atmosphere before great changes in the weather, particularly before great storms. I am persuaded, from my own observation, that, in general, sufficient indications of impending tempests precede them a considerable time, did we but carefully note them.

The phenomenon which I am going to mention, is one of those indications which not only portend an approaching tempest, but ascertain from what quarter it will come: a circumstance that may render it of essential service to seamen. I believe the observation is new, that the aurora borealis is constantly succeeded by hard southerly or south-west winds, attended with hazy weather, and small rain. I think I am warranted from experience to say, constantly; for in twenty-three instances that have occurred since I first made the observation, it has invariably obtained. However, I beg leave to request that you will recommend it to the notice of the Royal Society, as a matter which, when confirmed by further observations, and generally known, may be of more consequence than at first appears. To show that it may, give me leave to recite the circumstance which first occasioned my taking notice of it. Sailing down the English Channel in 1769, a few days before the autumnal equinox, we had a remarkably bright and vivid aurora the whole night. In shore, the wind fluctuating between N. N. W. and N. W., and farther out W. N. W.; desirous of benefitting by the land wind, and also of taking advantage of an earlier ebb tide, I dispensed with the good old marine adage, "Never to approach too near a weather-shore, lest it should prove a lee shore," and by short tacks clung close along the English coast. Next day the wind veered to the S. W., and soon after to S. S. W. and sometimes W. We were then in that dangerous bay between Portland and the Start Point, and carried a pressing sail, with hopes of reaching Torbay before dark; but night came on, with thick haze and small rain, insomuch that we could not have seen the land at the distance of a ship's length. The gale was now increased to a storm: in this dilemma nothing remained but to endeavor to keep off the shore till the wind should change. Luckily, our ship was a stout one, and well rigged.

Reflecting, some time after, on the circumstances of this storm, and the phenomena that preceded it, I determined to have particular attention to future auroræ, and the weather that should succeed them; and, as I observed above, in twenty-three instances have found them uniform, except in degree; the gale generally commencing between twenty-four and thirty hours after the first appearance of the auroræ. More time and observation will probably discover whether the strength of the succeeding gale is proportionate to the splendor and vivacity of the aurora, and the distance of time between them. I only suspect that the more brilliant and active the first is, the sooner will the latter occur, be more violent, but of shorter duration, than when the light is languid and dull. Perhaps, too, the color of the aurora may be some guide in forming a judgment of the coming gale. That which preceded the storm I have mentioned, was exceedingly splendid. The tempest succeeded it in less than twenty-four hours, was violent, but of short continuance. In June last, a little without soundings, we had for two nights following faint inactive auroræ; the consequent gale was not hard, but lasted nearly three days; the first day attended with haze and small rain, the second with haze only, and the last day clear.

The benefit which this observation on

the aurora borealis, when further confirmed, may be to seamen, is obvious, in navigating near coasts which extend east and west, particularly in the British Channel. They may, when warned by this phenomenon, get into port, and evade the impending storm; or, by stretching to the southward, facilitate their passage by that very storm which might otherwise have destroyed them; for no winds are so dangerous in the Channel as the southerly and south-west. In a word, since I have made this observation, I have got out of the Channel, when other men, as alert, and in faster sailing ships, but unapprized of this circumstance, have not only been driven back, but with difficulty have escaped shipwreck.

Perhaps the observation, that southerly gales constantly succeed these phenomena, may help to account for the nature of aurora borealis. My own thoughts on that subject I shall sometime beg leave to lay before you. J. S. Winn.

[From the same.]

Contact of Comets.—In the course of a lecture on comets, delivered at the Royal Institution, by Dr. Lardner, on Friday evening, the 1st of May, the lecturer took occasion to allude to a report which has been going the rounds of the newspapers, purporting to come from Sir John Herschel, to the effect that Halley's comet, which is expected to make its appearance in the course of the present year, had long since changed its course, and now revolved in another orbit. Dr. L. observed, that Sir J. Herschel had not any means of ascertaining such a change, other than those possessed by any other astronomer; and he was of opinion that the paragraph was either a fiction, or else greatly exaggerated, exemplifying the story of the three black crows. There are only two circumstances from the occurrence of which the orbit of a comet can be changed. In its course it may meet with a planet, the attraction of which may be sufficient to produce such an alteration, or it may cross the path of another comet, and either coalesce with it, or be acted on so as to produce that effect. Sir J. Herschel, however, has no means of ascertaining that either of these circumstances has occurred in the present instance, and Dr. L. sees no reason to doubt that the comet will make its appearance.

In the course of the lecture, Dr. Lardner mentioned a curious fact relating to the splendid comet which appeared in June 1770, and was observed by Messier, surnamed by Louis XIV. the *comet ferret*. It passed within the orbit of Jupiter, and was visible in an unusually large part of its course, which was very carefully observed and noted. Messier not being a mathematician, Lexon computed the observations, and laid down its path. He at first considered its course was a parabola, but not being able to compute it correctly according to that supposition, he examined further and ascertained that its orbit was an ellipse, and its course would be completed in about five years and a half. Considerable attention was excited on this occasion, and its re-appearance anxiously looked for; the time passed, however, and the comet did not make its appearance, nor could any account of any previous visit be discovered.

This fact proved a complete problem until Laplace grappled with it; and he ascertained by accurate investigation, that this comet of 1770, during its course, on the 18th of January, 1767, at noon, came in contact with the planet Jupiter, and remained entangled for about six months. Previous to this it described an orbit of fifty years, but the new orbit in which it revolved after its contact with Jupiter, was one of five years and a half. In this manner Laplace accounted for its non-appearance previous to 1770, inasmuch as previous to that date its path was so distant as to render it invisible. The explanation given for its non-recurrence was equally feasible. Jupiter runs its course in eleven years, and this comet in its new orbit completed its revolution in five and a half. At the end, therefore, of the first five years and a half, the planet Jupiter being then at a great distance, the comet should have been seen, but it so happened that at that time the earth was in such a position with regard to the sun, as to render it invisible. When the period approached for the completion of its second revolution, it was again met by the planet Jupiter, and again its orbit was changed. The ellipse into which it was thrown this time was one of 20 years, and its path was so distant as to render it again invisible.

[From the Journal of the Franklin Institute.]

REMARKS ON COMPETITION PLANS FOR BUILDINGS.—Every person, whose attention has been in the least degree directed to architecture, must have observed that, in the present day, the practice of procuring plans for buildings, by public competition, is becoming more and more prevalent. It is, perhaps, only of late years that this custom has been generally acted upon; and it is more commonly employed in the case of public buildings than in those of a private nature. When a public building is about to be erected, the parties advertise a description of what is wanted, offering, generally, a premium for the best plan, or for that which shall be finally adopted. Sometimes the successful competitors have nothing for their reward but that of being employed to conduct the work, for which they are paid as in ordinary cases. The plans submitted are, or should be, distinguished by a private mark, referring to a sealed letter sent by the competitor, in which his real address is to be found; and it not unfrequently happens that there will be from forty to fifty of such plans sent in, varying, of course, in equally numerous degrees of merit. Not a few of these drawings are the result of great labor, seldom occupying the time of the competitor for less than three weeks, and, if the building be very extensive, and the design well matured, having employed his sole attention for months together. The unsuccessful competitor, consequently, sustains a very serious loss; as he is not like the landscape or figure painter, who can carry his drawings to the market; the plans of the architect can be of no use but for the purpose for which they were originally intended. In fact, there cannot be, in any other profession, a competition which requires such a sacrifice on the part of the competitor, as in architecture; and, were this sufficiently impressed on the public mind, there can be no doubt but the labors of the architect would, in all such cases, be more duly appreciated, and, at least, rewarded with an impartial distribution of justice.

It may here be remarked, that sufficient time is seldom allowed by the advertisers for preparing the plans; for it will be confessed by every architect, that the faults of his composition will be easier detected by himself, after it has been laid aside for a time; we should say, therefore, that six months, at least, should be given, or even a longer period, according as the subject may require.

Although the system of competition in architecture is accompanied with no small expense to the parties competing, yet it cannot be denied that, when rightly conducted, it is conducive to the greatest advantages to the public, and is the only true method of eliciting the brightest talents of the country, especially when the premium held out is of sufficient value to induce proficient architects to come forward with their works; and, surely, the erection of a building which is destined to continue for ages, standing forth to prosterity as an example of the architectural genius of our time, is not unworthy of the most assiduous attention. The practice has also a beneficial effect, in affording to a young architect facilities, which he could not otherwise possess, of pushing himself forward. Private competition plans are sometimes required, where the competitors are previously chosen out, and where all are paid a certain amount for their trouble, whether successful or not; this is certainly the most liberal method, and should be adopted where the funds are sufficient.

In most cases where a decision is made on competition plans, the judges consist of men who are but indifferently qualified for the task, and whose fancy is easily carried away by a gaudy picture, the intrinsic merits of which they are incapable of appreciating; or, perhaps, by a design which has nothing else to recommend it but that of being so common-place in its character, as to be more familiar to their ideas than one of higher pretensions. Indeed, it is not to be supposed that men, whose pursuits of life are so totally unconnected with the subject, as never even to have led them to the inspection of a simple plan of a house, should be able to form a correct judgment of a number of elaborate drawings. It often happens, indeed, that the judges are so bewildered with the brilliant display before them, that they readily give way to some almost equally ignorant but pretending builder, to whom they look up as to the architectural oracle of their body, and who, it may be supposed, will not let slip such an opportunity of serving his own ends. This may, perhaps, be thought rather an uncharitable conclusion; but, certainly, there is but too much reason to fear that sinister influences have, in many cases, had an undue weight, and it is the particular object of this article to point out these grievances.

On such occasions as that we are just referring to, the most obvious method of proceeding, and that which would be the most entirely free from all suspicion of partiality, would be to name two or more architects, of acknowledged celebrity in their profession, (and residing at a distance,) to whom the plans should be sent for final decision. Care should also be taken by all

judges, in forming their decision, to keep in mind the terms of the competition; for, although the value or cost of the building required by the advertisement be strictly attended to by some competitors, yet there are others who will disregard it, and will produce an elegant design, although its expense should be double the stipulated estimate, and who, by this trick, may blind the judgment of the umpires, and carry off the prize.

The undue means which are sometimes resorted to by competitors to forward their own cause, are disgraceful in the extreme: some have been known openly to carry about their designs, for the purpose of procuring votes, before the general election; some unfairly attach their names to their plans, (instead of using a private mark, as they ought to do,) in the hope that their friends may exert undue influence in their favor, or form a vain confidence in their own importance, which leads them to expect that the name alone will produce a favorable impression; and some have even been known surreptitiously to withdraw their designs from the exhibition, in order to add improvements which have been suggested by the designs of another: nay, such is the total want of principle, and disregard of justice to the competitors, shown in some cases, that an instance could be brought forward where one of the competitors was appointed the judge! This competitor judge most naturally gave his decision in favor of his own designs, and the unsuccessful competitors were dismissed with the most cogent and satisfactory argument, that "the judge was a man of such respectability, that he would not have chosen his own design, unless he had considered it the best!" Is it possible to conceive that language could be so sophisticated as to apologise for such conduct? Thus it is that nine out of ten competitions are decided, and thus are the architects treated who have spent a large portion of their valuable time for the benefit of the public. It must be acknowledged, however, that isolated cases occur, though few and far between, where no complaints of this nature can be made, and where fair play has been allowed to have had full scope. The Tron Church steeple, Edinburgh, erected, in 1828, by the architects Messrs. R. and R. Dickson, may be mentioned as an instance of fair competition; the choice of the plan reflects the highest credit upon the then magistrates of the city, who made their election from a great number of designs. Considering its cost, this steeple, for aptness, originality, and picturesque beauty, can scarcely be surpassed in any country. It would not be easy to cite many instances of the same kind in Scotland, but we may mention another, viz.: Burns' monument at Ayr, by Thomas Hamilton, Esq., of Edinburgh. This is an exquisite gem of Grecian architecture, of which school its tasteful architect is a distinguished disciple. Finally, it is evident that the grievance here complained of, and which calls so loudly for redress, is in no way amenable to the civil law, unless in such a case as we have before hinted at, viz.: where the judges do not abide by the advertised terms of the competition. Even in such cases, we are not sure how far they lay themselves open to have their proceedings legally called in question, so that an appeal can only be made to the moral rectitude of society; and we have no doubt that the evil only requires to be fairly exposed, to be, in time, totally eradicated.

Edinburgh, October, 1834.

Franklin Institute.—The seventh conversation meeting of the Institute, for the season, was held at their Hall April 23d, 1835.

Mr. Thomas Ewbank, of New-York, exhibited a series of experiments on the rarefaction produced in the air within a tube, by blowing through another tube inserted into the first; the tubes were variously connected, and proportioned in dimensions, and the degree of rarefacation produced in each was measured by the rise of a column of water into the tube.

Mr. Ewbank showed that this principle might be applied conveniently to syphons, the flow of water through them being commenced by blowing through a lateral tube. He also exhibited a syphon, the shorter leg of which terminated in a tube, widening as it receded from the bend, and which was filled by stopping the longer leg with the finger, and immersing the other leg of the syphon in a liquid; on the removal of the finger, the momentum of the liquid carried it up the shorter leg, passing the bend.

Messrs. Lehman & Duval, of Philadelphia, exhibited various specimens of lithography, drawn and printed at their establishment.

Professor W. R. Johnson showed an apparatus intended to illustrate the principle upon which rockets ascend, and to show that such ascent might take place in vacuo, and, therefore, could not be produced by the re-action of the gas, issuing from the rocket upon the air without. The apparatus consisted of two revolving arms, with opposite apertures, like those of Barker's mill; this was placed in an exhausted receiver, and set in motion by admitting air through the apertures into the receiver. The arms were furnished with broad wings,

presenting a large surface to resist the motion through air. The velocity was perceived to be greater as the vacuum was more perfect.

SOURCE OF ANIMAL HEAT.—From observations lately made by Mr. Hermann, it would appear that the modern doctrine of the formation of animal heat is founded upon just grounds. According to this theory, animal heat is nothing but a chemical product, resulting from a process analogous to combustion, and which takes place during the respiration. In this theory, animals who do not form any water by their respiration, ought to produce as much caloric as the carbon which they transform into carbonic acid would emit by being consumed. This proposition has been confirmed on three chaffinches on which Mr. Hermann lately experimented. In the space of forty-eight hours these birds reduced to a liquid, in the calorimetre of Lavoisier, 16,965 grains of ice, and 1652 grains of carbon were found in the nutriment which the birds had taken during that time. These numbers accorded very closely with those resulting from theory; for if we admit that one part of the carbon, while being converted into carbonic acid, melts 104 parts of ice, the 102 grains of carbon should melt 17,180 grains of ice.—[Scientific Tracts.]

METEOROLOGICAL TABLE,

For the months of June and July, 1835—kept at Avoylle Ferry, Red River, Lou., (Lat. 31° 10′ N., Long. 91° 59′ W. nearly,) by P. G. VOORHIES.

JUNE.

Days.	Morn.	Noon.	Night.	Wind.	Weather.	Remarks.
1	71	84	71	calm	clear	light showers in the morning—wind N.W.
2	70	82	72	W	cloudy	light showers morning and ev'g—had roasting ears for dinner
3	70	83	79	calm	clear	cloudy m'g—clear at noon
4	72	86	82	..	..	
5	72	87	76	..	..	
6	70	88	82	SE	..	Red river on a stand
7	75	88	84	..	..	
8	72	77	84	S	..	
9	70	84	74	E.light	..	rain in the evening—Red river falling
10	73	81	73	calm	..	heavy rain in the even'g
11	72	78	86	SW	cloudy	clear at noon
12	71	86	74	calm	clear	
13	74	81	77	..	cloudy	rain in the evening
14	73	79	75	..	..	.. morning and noon
15	72	77	76	..	..	clear in the evening
16	71	84	78	..	..	rain in m'g—clear at noon
17	74	85	82	..	clear	
18	73	88	82	..	..	
19	73	88	86	..	..	
20	75	87	85	..	..	
21	74	86	78	..	..	
22	72	81	78	..	cloudy	clear at noon
23	73	87	77	..	clear	rain in the evening
24	72	85	79	..	cloudy	light showers at noon
25	75	82	82	..	..	rain and thunder at noon—clear evening
26	74	84	80	..	..	light showers at noon
27	77	85	76	..	..	.. .. .. —clear evening
28	79	86	83	..	clear	thunder at noon
29	72	88	84	SW	..	
30	79	88	82	calm	..	rain and thunder in ev'g

Red river rose this month, 1 foot 4 inches—and is below high water mark, 6 feet 6 inches.

JULY.

Days.	Morn.	Noon.	Night.	Wind.	Weather.	Remarks.
1	68	72	71	SW	cloudy	rain in the morning, & clear in the evening
2	62	78	70	calm	clear	
3	61	77	74	..	..	
4	70	80	76	..	cloudy	
5	71	77	73	..	..	drizzly rain all day
6	68	80	76	..	clear	Martin birds left here
7	67	82	75	SE	cloudy	thunder and rain in ev'g
8	70	84	77	calm	clear	
9	74	84	73	..	cloudy	very heavy rain in afternoon, and thunder
10	73	80	73	SW	..	very heavy rain in ev'ng
11	73	80	76	calm	..	Red river on a stand
12	73	84	75	SE	clear	thunder st'm at noon,& little rain—wind S.E.
13	73	84	81	calm	..	foggy morn'g—thunder at noon and evening
14	74	88	76	..	cloudy	thunder in the morning, rain noon and ev'ng
15	71	79	76	..	..	clear in the evening—Red river rising
16	71	83	79	..	clear	
17	72	85	82	..	cloudy	
18	73	82	72	..	..	rain in ev'ng and all night
19	70	72	70	..	..	.. all day
20	71	75	74	N. E. light	..	rain all day, and showers at night
21	72	73	72	E	..	.. ..
22	72	78	73	calm	..	rain severe in forenoon, evening clear
23	70	81	79	..	clear	thunder in forenoon, & cloudy in evening
24	74	85	82	..	..	foggy morning—clear balance of the day
25	74	86	83	..	..	.. ..
26	80	89	82	..	..	thunder, wind S.W. in ev'g
27	74	87	84	..	..	rain in ev'ng, & thunder
28	78	86	84	..	..	
29	76	89	86	..	..	
30	76	89	78	..	..	rain and thunder in ev'ng
31	75	84	82	..	cloudy	foggy morning—showers at noon

Red river rose this month, 6 inches—below high water mark, 6 feet.